Lowell Textile Institute

Supplementary Bulletin

1950

Textile and Colonial Ave., Lowell, Massachusetts

Series 53, No. 3 February, 1950

BULLETIN

OF THE

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1950

Entered August 26, 1926, 1902, at Lowell, Mass., as second-class matter under Act of Congress of July 16, 1894

Acceptance for mailing at special rate of postage provided for in section 1103 Act of October 3, 1917, authorized October 21, 1918

Textile and Colonial Avenues

Publication of this Document Approved by George J. Cronin
State Purchasing Agent

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Lowell Textile Institute

announces

COURSES

in

Paper Engineering

Leather Engineering

beginning

September 1950

DEPARTMENT HEADS

DR. GEOFFREY BROUGHTON—*Paper Engineering*

DR. ALBERT E. CHOUINARD—*Leather Engineering*

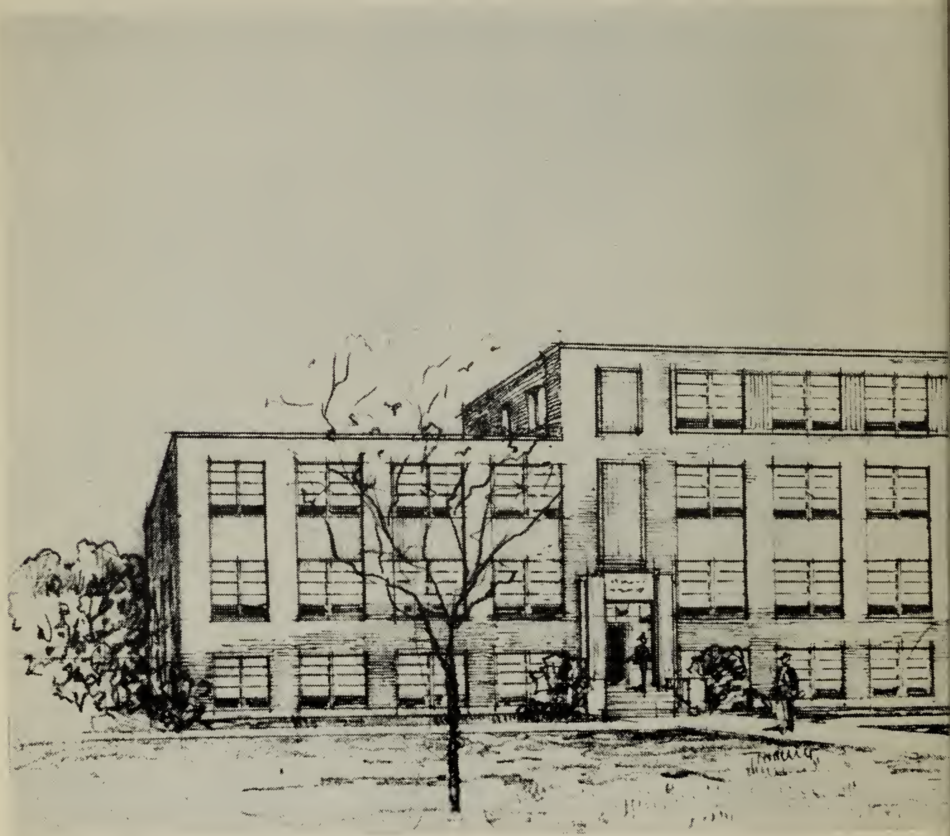
Paper Engineering

Massachusetts has long been a leader in the fields of paper manufacture and converting, there being eighty-two paper mills and approximately two hundred and fifty converters in the Commonwealth. The industry, in fact, ranks sixth in dollar volume and has a continual demand for college trained men with proper technical background.

Commencing in September 1950, the Institute will offer a four year course in Paper Engineering, leading to the Degree of Bachelor of Science. This course will emphasize paper manufacture, converting and paper use, approaching these subjects from the basic engineering and chemical principles involved. Provision will be made for practical experience in paper mills and converting plants.

A new building, erection of which began early in 1950, will contain one floor, approximately 12,000 square feet in area, devoted to the Department of Paper Engineering. This will be ready for occupancy in time for students admitted in 1950 to utilize the new facilities. These will comprise fully air conditioned testing rooms, a large engineering laboratory for unit operations, a coating laboratory and converting laboratory to house machinery for laminating, embossing, printing and other pertinent operations.

During the first two years, the curriculum will be similar to that of Course IV in Chemistry and Textile Coloring (p. 38 Official Bulletin). In the third year more fundamental subjects, such as Physical Chemistry, Electronics, Electrical Engineering will be taken up, while a start will be made on the professional subjects of the Paper Engineering curriculum. These will comprise wood technology, pulp and paper manufacture and paper testing methods. In the fourth year certain basic subjects, such as Electrical Engineering will be continued, but increasing emphasis will be given to pulp and paper manufacture, paper coating and converting. Suitable contacts with the paper industry to emphasize actual working equipment and experience will be maintained.



PAPER & LEATHER ENGINEERING BU

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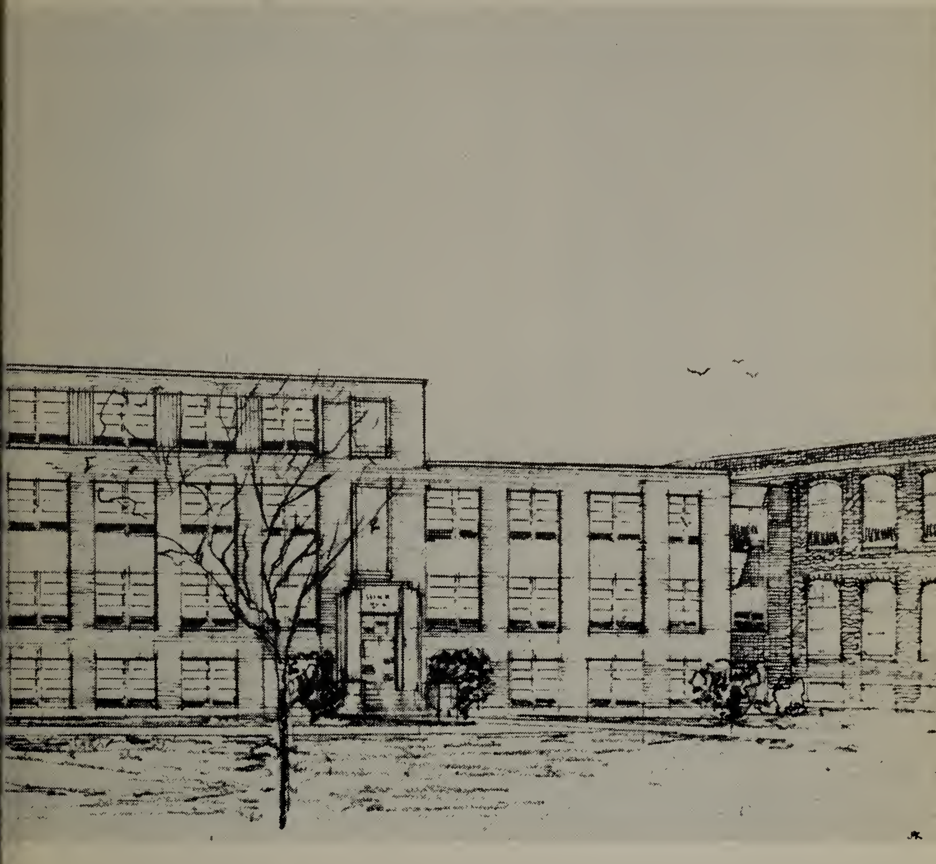


NG FOR LOWELL TEXTILE INSTITUTE

ITECTS, BOSTON, MASS.

Leather Engineering

A Department of Leather Engineering has been established at Lowell Textile Institute and will be ready to admit students in September 1950. This is a project that has been visualized for several years and is now an established fact. The leather industry, which originally settled in Massachusetts and which has since become an important factor, offers excellent opportunities to young men properly equipped with a scientific and engineering background rounded out with a thorough and systematic training in the fundamentals of Leather Technology.

A Paper and Leather Engineering building is under construction and is expected to be completed in 1951. One entire floor of this building will provide space for the specialized facilities of this department. The laboratories will be devoted to research and practical demonstration in the field of leather. The space provided in the new building, as well as the facilities already existing in the Institute, will provide adequately for the needs of the new department.

In formulating the engineering curricula, emphasis will be placed on the fundamentals of engineering, including mathematics, physics, chemistry, and theoretical and applied mechanics. In addition to adequate training in the principles of leather technology, time will be allowed for the social sciences, that is, the sciences which deal with human relations, and the methods of business organization and administration.

The work of the first two years will be concerned mainly with the teaching of the basic sciences and probably will follow the general pattern of Course IV (Chemistry and Textile Coloring) and Course VI-E (The Engineering option of Textile Engineering.) The third and fourth years will be devoted to a sound training in Leather Technology and the application of engineering fundamentals.

Revised Admission Procedure

I. Due to changes in schedule recently announced by the College Entrance Examination Board, the following revision in our "Requirements" p. 15, Official Bulletin has been made necessary.

3. All candidates must arrange for and complete the following tests which are given by the College Entrance Examination Board.

a. Scholastic Aptitude Test (Verbal and Mathematical Sections)

b. An Achievement Test in each of the following.

Physics — one hour

Chemistry — one hour

Intermediate Math — one hour

It will be noted that the Social Studies Test has been dropped as a requirement.

We recommend that applicants take these tests on May 20th when possible.

II. Lowell Textile Institute does not admit new students at mid-term. An exception is made only in the case of transfer students whose previous courses are considered by the Faculty to be the equivalent of the Institute's required subjects.

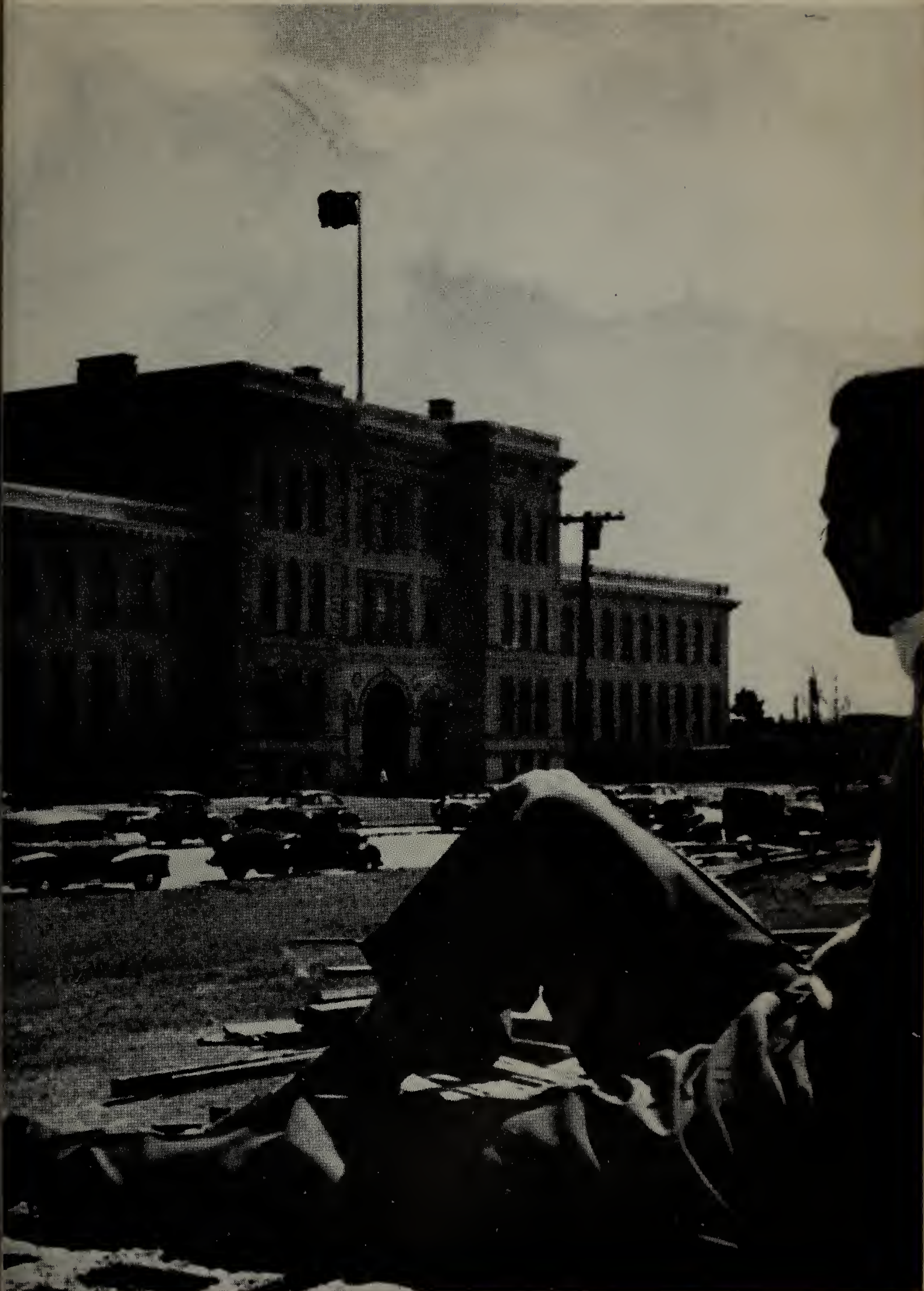
Lowell Textile Institute Calendar for 1950-1951

Re-examinations	September 13-15
Registration for all students	September 13
Freshman Orientation	September 13-15
All classes begin	September 18
Columbus Day — Holiday	October 12
Thanksgiving recess begins at 11:20 A.M.	November 22
Thanksgiving recess closes at 6:00 P.M.	November 26
Christmas recess begins at 4:20 P.M. .	December 15
Christmas recess closes at 8:30 P.M. .	January 1
First semester examinations begin . .	January 15
End of first semester	January 26
Second semester begins	January 29
Washington's Birthday — Holiday . .	February 22
Spring recess begins at 4:20 P.M. . .	March 22
Spring recess closes at 6:00 P.M. . .	April 1
Patriot's Day — Holiday	April 19
Second semester examinations begin .	May 21
Memorial Day — Holiday	May 30
Commencement	June 4

BULLETIN
OF
Lowell Textile Institute

Catalogue Issue for 1950-1951 Session

Textile and Colonial Ave. Lowell, Massachusetts



Southwick Hall

Smith Hall

SERIES 53, No. 4 *May, 1950*

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The Institute reserves the right to make changes in the regulations and courses announced in this Bulletin.

LOWELL TEXTILE INSTITUTE

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FOR

1950-1951

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OF THE LOWELL TEXTILE INSTITUTE

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Winford S. Nowell, B.M.E. .... 8 Fulton St., Methuen
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Instructor in Chemistry

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Instructor in Chemistry

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Associate Professor of Knitting

John A. Goodwin, B.T.E. ... 105 Chestnut St., Lowell
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Ferrell G. Kent, Dipl. Cotton Mfg. ... 18 Willow St., Melrose
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Edward L. Golec, Dipl. Textile Design ... 32 Elsmere Terrace, Dracut
Assistant Professor Design

Martin J. Hoellrich, Cert. in Weaving ... 30 Saxonia Ave., Lawrence
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John L. Merrill, B.T.E. ... 2026 Middleex St., Lowell
Assistant Professor of Weaving

George G. Armstrong, Jr. ... 26 Adams St., Littleton
Instructor in Weaving

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Instructor in Design

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James C. Riley, A.B. ... 4 Hanks St., Lowell
Assistant Professor of English

Louis W. Stearns, B.S., M.A. ... 20 Stedman St., Chelmsford
Instructor in English

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Instructor in Economics

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Albert E. Chouinard, B.S., M.S., Ph.D. ... Lakeview Ave., Tyngsboro
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Professor and Head of Department

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Instructor and Coach

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Charles F. Edlund, S.B., Ed.M. ....68 Baldwin St., Lowell
Professor and Head of Department

John R. Robertson, A.B., A.M. ....Topsfield
Assistant Professor in Social Sciences

Stuart L. Mandell, A.B., M.B.A. ....15 Bradford Ave., Bradford
Instructor in Social Sciences

DEPARTMENT OF SYNTHETIC TEXTILES

Chapin A. Harris, B.S., Ph.D. ....20 Sunset Ave., Chelmsford
Professor and Head of Department

Jacob K. Frederick, Jr., B.S. ....4 Barton Ave., Lowell
Assistant Professor of Synthetic Textile Manufacture

DEPARTMENT OF TEXTILE ENGINEERING

Herbert J. Ball, S.B., B.C.S., F.T.I. ....34 Pentucket Ave., Lowell
Professor and Head of Department

A. Edwin Wells, B.T.E., Ed.M. ....37 Ashland St., Melrose Highlands
Professor of Engineering

Harry C. Brown, S.B. ....272 Merrimack St., Lowell
Associate Professor of Engineering

Milton Hindle, B.T.E. ....25 Thurston Rd., Melrose Highlands
Associate Professor of Engineering

Horton Brown, B.S. ....178 Atlantic Ave., Marblehead
Assistant Professor of Engineering

Maurice E. Gelinas, S.B., A.M. ....283 Textile Ave., Lowell
Assistant Professor of Engineering

Andrew A. Ouellette, B.S. ....44 Taylor St., Nashua N. H.
Assistant Professor of Engineering

Henry E. Thomas, B.T.E. ....779 Westford St., Lowell
Assistant Professor of Engineering

J. Arthur Ainsworth, B.S., M.S. ....69 Amherst St., Nashua, N. H.
Instructor in Engineering

James W. Bell, Dipl. Electrical Engineering ....Smith Hall, Lowell
Instructor in Engineering

Isaac Chase, Jr., B.S. ....52 Gay St., No. Chelmsford
Instructor in Engineering

Robert K. Devejian, B.S. ....9 Arch Ave., Haverhill
Instructor in Engineering

Philip A. Hall, B.S. ....11 Marlborough St., Lowell
Instructor in Engineering

Elliot F. Humiston, Jr., S.B. ....12 Guild St., Lowell
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Instructor in Wool Mfg.

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Assistant Professor of Wool Manufacture

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Ann G. Groves .... 465 Pine St., Lowell
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S. L. Mandell 1951
J. J. MacLaughlan 1952

ALUMNI ASSOCIATION

The membership of the Alumni Association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has satisfactorily completed at least one year of the day curriculum. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

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HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

The Lowell Textile Institute, formerly known as the Lowell Textile School, was incorporated under the laws of Massachusetts in 1895 and functioned as a private institution and a recipient of state aid for several years following its inception. Its formal opening took place on January 30, 1897 with a teaching staff of thirteen and a student body of thirty-three. The school occupied rented quarters in downtown Lowell until the completion of Southwick Hall, the first of its present buildings, in January, 1903. The property of the school was transferred to the Commonwealth of Massachusetts in July, 1918 and since that time control and management have been vested in a Board of Trustees appointed by the Governor.

The name of the school was changed to Lowell Textile Institute in 1928 in order to indicate more clearly the standing of the institution.

PURPOSE AND SCOPE OF THE INSTITUTE

According to the original act authorizing its establishment, the Institute was founded "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry". Throughout the years it has steadily broadened its scope both in physical equipment and educational service, keeping pace with the progress of the industry it serves. In a continuing effort to render the greatest possible educational opportunities to the Commonwealth, the program of the Institute will again be broadened, beginning in September, 1950, to include curricula in Paper Engineering and Leather Engineering.

During the early years of the Institute's existence, in keeping with its initial educational objectives, no degrees were offered but diplomas were given for the completion of specified courses of study. However, in 1913, the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) were conferred on those students who completed four years study in one of the several curricula offered at the Institute. Gradually, all diploma courses were discontinued and all vocational work was transferred to the Lowell Evening Textile School program which is described in another bulletin.

In response to a continued demand for advanced study in Textile Chemistry, Textile Engineering or Textile Manufacturing, the Institute initiated graduate programs in these fields and awarded its first Master of Science degrees in 1935.

Recognizing that the general trend of its educational service, as reflected in its various curricula, has been constantly broadening in scope, the Institute is now offering the degrees of Bachelor of Science in Textile Chemistry, in Textile Engineering, or in Textile Manufacturing. The first of these degrees were conferred in 1947.

With the inauguration of the new Paper Engineering and Leather Engineering courses, it is planned to offer the degrees of Bachelor of Science in Paper Engineering or Bachelor of Science in Leather Engineering to graduates in these fields. Graduate study programs in either of these fields will lead to the corresponding Master of Science degrees.

The curricula of the Institute have been and are under constant study. Revisions and additions have been made in order that the Institute may continue in its traditional purpose of service to the industries. In choosing the present curricula, the Administration and Faculty have been aware of their obligation to prepare students for entrance into the industry of their choice whether it be the Textile, Paper, Leather, or similar fields. In addi-

tion to fundamental courses in the physical sciences and engineering, considerable work in practical industrial application has been included. Broadening yet practical courses in English and the social sciences have been woven into all curricula in a conscious effort to produce graduates who are not only well trained technically but are prepared to take their places in society. It has been recognized in the preparation of these curricula that no college program can adequately produce a specialist. The aim is to provide the student with a solid fundamental background and to predispose him to obtain additional and specialized education after graduation.

COEDUCATIONAL

Within the last few years, the possibilities for women in certain branches of the textile field have become recognized; and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, since it offers a broad training that prepares for many lines of activity. For those who wish to specialize in structural and decorative textile designing, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

BUILDINGS, GROUND, AND EQUIPMENT

The Institute occupies a commanding site on the west bank of the historic Merrimack River, overlooking the rapids of beautiful Pawtucket Falls which furnished the first extensive use of water power in America for the operation of power looms. The high elevation consists of about 15 acres, contributed by Frederick Fanning Ayer, Esquire of New York City and the Proprietors of the Locks and Canals on the Merrimack River.

Southwick Hall, the main building, fronting on Textile Avenue, was contributed by the Commonwealth of Massachusetts and Frederick Fanning Ayer, Esq., and is a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days, and a maternal ancestor of Mr. Ayer. It includes a central mass 90 by 90 feet, having three stories and two wings 80 by 85 feet each with two stories and well-lighted basements. The building is pierced in the center by an archway through which access is had to the central courtyard. The northern wing is occupied by the General Offices, Engineering and Finishing Departments, while the southern wing is occupied by the Chemistry and Dyeing Departments.

Kitson Hall, dedicated to the memory of Richard Kitson, was contributed by Charlotte P. Kitson and Emma K. Stott, his daughter; the Kitson Machine Company of Lowell, founded by Mr. Kitson was also a generous contributor. This hall makes a right angle with Southwick Hall, is 70 by 183 feet, has two stories and a basement and houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories and the Machine Shop.

The Falmouth Street Building forms the third side of the quadrangle, and consists of three portions, one 60 by 75 feet, three stories, one 75 by 130 feet, three stories, and the head house 70 by 80 feet, three stories and basement. The building is occupied by the picker section of the Cotton Yarn Department, the Design and Power Weaving Department, the Woolen and Worsted Yarn Department, the Department of Synthetic Textiles, and contains on the lower floors equipment for the manufacture of wool yarn from the fleece to the finished yarn. The upper floors are occupied by a great variety of plain, dobby and Jacquard looms, and in a section of the building are the students' lockers and recreation rooms.

Louis Pasteur Hall. By means of a special appropriation made by the Legislature of 1937 a three-story addition was placed on a single-story building erected in 1910 and previously known as the Colonial Avenue Building. This Hall contains on the first floor the Cotton Finishing laboratory as well as classrooms and offices of the Wool Department. On the upper floors are found the laboratories, class and lecture rooms, library, and research laboratories of the Chemistry, Textile Coloring, and Finishing Department.

The Paper and Leather Building, construction of which began early in 1950, will be completed in time for students enrolling in the Institute in September, 1950, to utilize its facilities. One floor of the building, approximately 12,000 square feet in area, will be devoted to the Department of Paper Engineering. There will be fully air conditioned testing rooms, a large engineering laboratory for unit operations, a coating laboratory and a converting laboratory. The Paper Department area will also house machinery for laminating, embossing, printing and other pertinent operations. An entire floor of the Paper and Leather Building will contain the facilities of the Department of Leather Engineering. The laboratories in this section will be devoted to research and practical demonstrations in the field of leather. The space provided in the new building, as well as the facilities already existing at the Institute, will provide adequately for the needs of the new department. The remaining floor space in the building will be allotted to the Physics Section.

The Alumni Library Building, now under construction, has become a reality as the result of contributions by the alumni and many members of the textile industry. This modern building, upon its completion during the summer of 1950 will be dedicated in honor of Lowell Textile men and women who served in the first and second world wars. In area the building is 120 feet by 65 feet and is of Neo-Gothic design. It has a book stack capacity of 80,000 volumes and its reading rooms will seat 150 students. The first floor contains four reading rooms, private study areas, the librarian's office, a book preparation room and book stacks extending above the second floor level. On the second story will be located a mezzanine study balcony, lounge, and alumni, committee and exhibition rooms. The basement will contain complete office facilities for undergraduate group activities as well as additional book stack space, private study areas, a book repair shop and storage rooms.

Dormitories. Modern, attractive living quarters are available for students in the two new dormitory buildings which are located directly across the street from the main Institute building.

All Freshmen and Sophomores, except those who have received permission from the Dean of Students to live at home or in fraternity and rooming houses, are required to live in the dormitories. Rooms are fully furnished, including linen and bedding, and are cared for by the students occuping them. Each occupant is held responsible for any damage done. Eames Hall is reserved for Freshmen. It contains accommodations for 112 men and has an apartment for the use of the faculty proctor and his wife. A Snack Bar and Recreation Lounge, replete with piano, fireplace corner and ping pong tables, makes Eames Hall a comfortable and interesting place in which to live. The Hall was named in honor of Charles H. Eames, former President of the Institute. Information concerning room assignments, roommates and other data will be sent to prospective freshmen concurrently with notice of the acceptance of their candidacy for admission.

Sophomores and other upperclassmen have their accommodations in Smith Hall which was dedicated in 1948 in honor of James T. Smith, pioneer educator in the textile field and the man primarily responsible for the organization of Lowell Textile Institute. Smith Hall has accommodations for

112 men, together with a faculty proctor. A resident nurse has quarters in the Hall and is available for twenty-four hours a day service to the students of the Institute. There is a cafeteria in the basement which caters to the entire student body and faculty of the Institute. Meals are carefully and tastefully prepared and are served at prices which suit individual budgets.

Assignment of rooms in the dormitories originates in the Office of the Dean of Students and all assignments are for the full academic year. Change of room is not permitted except under unusual circumstances, in which case the change may be accomplished only after permission has been secured from the Dean of Students. All rentals are uniform, the annual rate being $275.00 per year for each student. Assignment of dormitory rooms is made as equitably as possible and in the order that applications for accommodations are received. For those students who are unable to be placed in dormitories, the Dean's Office supplies a list of approved rooming houses where students may reside. When vacancies occur in the dormitories, students living in rooming houses may be compelled to relinquish these accommodations and accept dormitory room assignments made by the Office of the Dean of Students.

For further information concerning living accommodations, write directly to the Dean of Students.

Grounds and Equipment. Through the generosity of Mr. Frederick Fanning Ayer, the Institute has been provided with a campus and athletic field of about 3 acres. In addition to this field there has been developed during the past few years a larger area that was used for baseball for the first time during 1938. This is located northeast of the Institute buildings and will be further improved to make a modern athletic field for baseball and other sports.

The equipment in the various buildings is extremely varied and includes textile machinery covering all of the basic systems for handling staple and continuous filament fibers from raw materials to finished fabric. The textile equipment is closely integrated to modern laboratories in physics; chemistry; engineering; and chemical, physical and optical testing. All laboratories, including those with machines which are exact replicas of commercial models, are geared to both teaching and research.

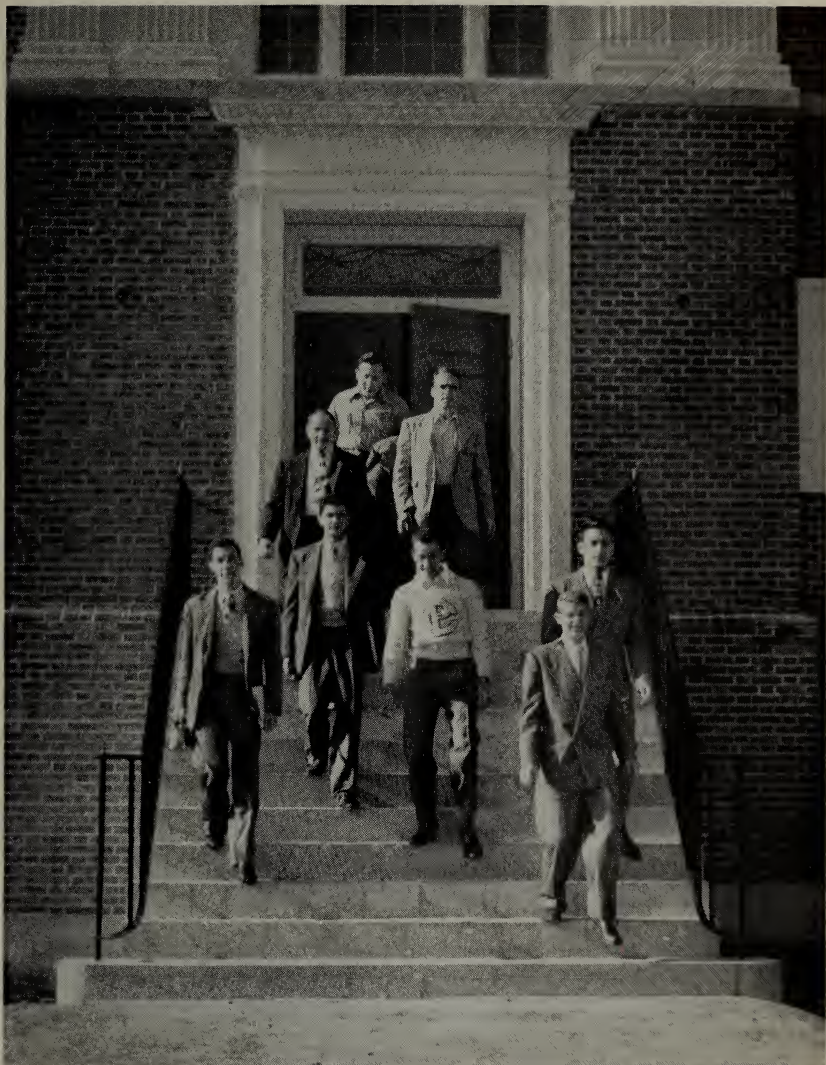
SPECIAL SERVICE

In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract with responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

RESEARCH

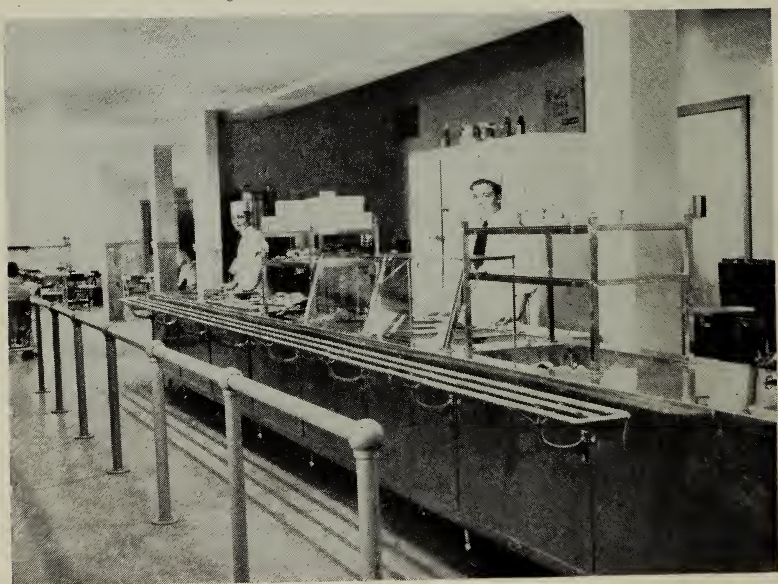
Two major projects are under investigation in the Research Department. Both of these are sponsored by outside agencies but facilities are provided by the Institute.

The oldest project is under the sponsorship of the Research and Marketing Administration of the United States Department of Agriculture and is an investigation of the properties of cotton yarn. The ultimate aim is the development of end-use performance characteristics which will enhance their behavior as fine-chain warps in carpet backing fabrics. Studies of yarn geometry and physical-chemical character are being employed to guide an engineering design for a better cotton yarn structure and thus obtain better end-use performance.



Smith Hall Main Entrance

Dormitory Room in Smith Hall



Cafeteria

The second project is being pursued in cooperation with the Massachusetts Department of Public Health and is sponsored by the Federal Security Agency of the United States Department of Public Health. This work is aimed toward a solution of wool scouring waste disposal in so far as it influences both stream and aerial pollution. Although stream pollution abatement is the primary motivation behind this work, new processing techniques are being studied to improve scouring procedure and to present to sanitary engineering a more tractable waste for treatment. Concomitantly, studies in by-product recovery and utilization are being undertaken in the interest of reducing the economic burden of waste disposal.

GENERAL INFORMATION

ADMISSION

Policy—New students at the Lowell Textile Institute are selected by a group of Faculty members functioning as the Committee on Admissions. The Committee endeavors to accept for membership in the freshman class those applicants who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership. In addition to test results, scholarly attainments, and other traditional standards of measurement, the Committee sets a high value on the personality characteristics of each individual candidate, together with his extracurricular interests and contributions to school and community life.

Procedure—Formal application for admission should be made as early as possible in the candidate's senior year of secondary school. Requests for application blanks and all correspondence relating to matriculation at the Institute, should be addressed to the Director of Admissions. Preliminary correspondence before the senior year is welcomed, and encouragement is extended to every effort which will tend to harmonize the prospective student's interests and activities with his freshman year at the Institute.

Steps to be taken for admission are:

1. Pages one and two of the admission application form should be completed by the candidate.

2. The whole application form should then be submitted to the office of the candidate's secondary-school principal, with the request that his office fill out pages three and four and mail the completed application directly to the Director of Admissions.

It is required that this procedure be accomplished by March 1, if the candidate wishes to be considered for admittance to classes beginning the next September. It is the responsibility of each individual applicant to ensure that his application has been properly completed and sent to the Committee at the Institute before March 1.

3. Application should be made to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey, preliminary to taking certain examinations described below under the heading Requirements.

4. Each applicant must submit to a complete health examination by his family physician. A certificate of good health, indicating the date of this examination, must then be sent by the physician directly to the Director of Admissions. No application for admission will be considered by the Committee until this certification has been received. The Committee has prepared a special form for the convenience of the physician; a copy of this certificate of health will be supplied on request.

5. A personal interview with the Director of Admissions is strongly recommended.

The Office of Admissions at the Institute is open for this purpose Monday through Friday, from 8:30 a.m. to 5:00 p.m. during the school year. It is suggested that appointments for an interview be made in advance.

Requirements—Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision as to the eligibility of an applicant shall be left to the discretion of the Committee on Admissions.

The conditions under which an applicant may be accepted are as follows:

1. A candidate for admission must be a graduate of a secondary school approved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of equal scholastic standing.

2. (a) Because of the specialized nature of the various curricula at Lowell Textile Institute, it has been deemed advisable that all entering students shall have completed the following units of secondary-school study:

Algebra (quadratics and beyond)	2 units
Plane Geometry	1 unit
English	4 units
American History	1 unit
Chemistry (including laboratory)	1 unit
or	
Physics (including laboratory)	1 unit

Preference will be given to applicants offering both Chemistry and physics. In addition to the above-listed prerequisites, each applicant must offer credit in elective subjects, such as: languages, other than English; history, other than American; mechanical drawing, solid geometry; advanced algebra; scientific subjects; social studies; and others. Trigonometry is recommended but not required.

(b) The combined prerequisites and electives should total at least 15½ Carnegie units. Each such unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week, or the equivalent.

(c) In evaluating the credits offered by an applicant for admission, the Committee will be guided primarily by the quality of his scholastic record and by his apparent promise on grounds of intellect and character. Therefore, an applicant whose preparation has not followed the normal pattern with respect to the accumulation of unit credits should not hestitate to apply for entrance, provided that the quality of his scholarship gives evidence of ability to do college work and provided that he is recommended by his school. (For additional information, see paragraph "Exceptions to Admissions Rules", below.)

3. All candidates must arrange for and complete the following tests which are given by the College Entrance Examination Board:

(a) Program 2—The Scholastic Aptitude Test and Intermediate Mathematics Test (three hours).

(b) Program 4—an Achievement Test in each of the following:

Pre-Engineering Science Comprehension
Physics
or
Chemistry
Intermediate Mathematics

These examinations are prepared, administered, and graded independently of the Lowell Textile Institute. Therefore, application to take the tests must be made directly to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey. Arrangements to take the tests, which are scheduled annually for the early part of March, should be completed as early as possible in the candidate's senior year in secondary school. Foreign students, particularly, should plan to make early arrangements, so that testing facilities can be set up near their homes. The examinations are given at various cities, throughout the world, so that no candidate should be placed under undue hardship in taking the tests.

Questions concerning the nature and scope of the tests, the location of testing centers, financial considerations, and the like, should be addressed directly to the College Entrance Examination Board. It is the full responsibility of each candidate for admission to Lowell Textile Institute properly to arrange for and complete the required tests.

Advanced Standing—A few exceptionally well-qualified students are admitted to advanced standing each year. Such candidates must submit their qualifications on a special form which must be filed before March 1, if the applicant expects to enter classes beginning the next September;—before November 1, for second-semester classes. The Advanced Standing Petition should be filed in addition to and independently of the regular admissions application; the former should be sent directly to the Director of Admissions by the candidate himself; the latter should be sent to the Committee by the candidate's secondary-school principal.

Transfer students are expected to have demonstrated outstanding ability, must submit transcripts of their college record and letters of honorable dismissal, and must supply cogent and positive reasons for wishing to enroll at Lowell Textile Institute. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

Because of the nature of the course of study at the Institute, it is usually difficult for a transfer student to construct a program which will be completely satisfactory. In general, a transfer can be accomplished only at the expense of sacrificing some time and credit. With that thought in mind, the Committee entertains consideration of advanced standing applications only when they include a well-developed plan of study, which the candidate submits as being acceptable and suitable for his purposes. The Director of Admissions will gladly advise prospective applicants concerning this plan of study, and other matters concerned with advanced standing, by means of correspondence, or interview, or both.

Occasionally, an undergraduate may leave the Institute to study elsewhere after which he wishes to return to the Institute. Re-entry under such conditions is by no means automatic. Each application will be considered in the light of its individual merits. Credit for courses taken at other institutions will be given wherever feasible, but the Faculty reserves the right to require that candidates for re-admission take such subjects as it deems necessary in the construction of a sound program, even though the course material may have been previously studied. Since each individual case is different, no hard-and-fast rule can be laid down, but in general, credit will be given only when good or superior work has been demonstrated.

Special Students—Although most applicants for admission will wish to enroll for the full four-year degree program, a few persons may wish to take specialized work without regard for degree credit.

Special students usually are expected to conform to the general rules and regulations as specified by the Faculty. Their plan of study may not be of a nature as to deviate markedly from the regularly formulated subject matter and laboratory courses; and acceptance to special status is contingent upon the consent of the instructor in charge of each course to which admittance is sought.

The Committee admits only a few highly qualified students to special status each year. For detailed information concerning specific programs, applicants should communicate directly with the Director of Admissions.

Foreign Students—Each year the Lowell Textile Institute regularly accepts for admission up to a maximum of 5% of the total number of students in any given class (freshman, sophomore, etc.) from foreign countries. There are no special procedures to be observed by foreign candidates, although it is urged that they endeavor to have the transcript of their secondary-school and/or college records, as well as all other admission materials, submitted in English, as early as possible in their final year of secondary school. It is assumed that all applicants have a considerable facility in speaking and writing English, and that they have financial resources sufficient at least for their first year of study.

It should be emphasized that foreign students will be expected to complete the same schedule of courses as is assigned to all other students.

It is suggested, as noted above, that early arrangements be made with the College Entrance Examination Board to have a testing center located near the candidate's home. In order not to work a hardship on foreign applicants, the Committee permits such candidates to substitute the spatial relations test for the achievement test in social studies. In all other respects, the admission procedures for foreign students are identical with those required of U. S. citizens.

Exceptions to Admission Rules—In special cases, at the discretion of the Faculty Committee on Admissions, applications may be accepted from candidates in the following categories:

1. Applicants who lack credit in specified required subjects because they are not offered in the course of study at their secondary school. Such applications will be considered only when the quality of work done in other departments is exceptionally high.

2. Applicants who offer credit in all the required subjects, but whose accumulation of unit credits does not total 15½. Very few students will find themselves in this category, because most secondary schools require at least 15½ units for graduation. However, the Committee is willing to recognize the possibility that a student, well-qualified in all other respects, should not be denied the opportunity to submit his application because of purely quantitative considerations.

3. Applicants who have not maintained a uniformly good scholastic average in all subjects, *but are otherwise acceptable,* may be required to pass certain tests given by the College Entrance Examination Board. These tests will be in subjects prescribed by the Committee on Admissions, and usually will be in addition to the examinations regularly required of all candidates.

4. Applicants from secondary schools which are not on an accredited list may be required to pass the tests of the College Entrance Examination Board in those subjects prescribed by the Committee on Admissions, in addition to, or in substitution of, the tests regularly required of all candidates.

ORIENTATION

Each freshman is expected to be in daily attendance beginning Wednesday, September 13, at 9:30 a.m., and to follow the prepared program which will be placed in his hands at that time. Late registration for all students at the Institute is subject to a five-dollar fine, unless accompanied by a medical or equally acceptable excuse.

Freshman Week—Freshman Week will be devoted to facilitating the adjustment of the beginning student to his new physical and social surroundings. Under the sponsorship of the Committee on Student-Faculty Relations a program of meetings, lectures, and conferences will be presented in order to acquaint the entering class with the traditions, customs, rules and regulations, courses of instruction, organizations, recreational and other facilities of the Lowell Textile Institute.

Faculty Advisors—During Freshman Week, each entering student will be assigned a member of the faculty who will serve as his faculty advisor for the next two years. The advisors function as a counseling link between the student and his academic and personal problems.

Effective Study Course—All new students at the Institute are required to take the course in Methods of Effective Study. It is of one semester's duration, with meetings scheduled once each week, and carries no credit. The course attempts to teach the student how to get the most out of his work at the Institute by efficient use of his time and talents.

GUIDANCE

A committee of faculty members supervises a guidance program which begins with the admissions procedures, continues throughout the undergraduate years, and culminates in the work of the Placement Office.

Because living on-campus is an important aid in helping the new student adjust to college life, it is required that all freshman and sophomore students, except those who have permission to live at home or in fraternity houses, take residence in the dormitories.

Guidance in the freshman year stems mainly from the results of the admissions testing program, Freshman Week activities, the Effective Study course, and the work of the Faculty Advisors. These same advisors function throughout the sophomore year, but during the junior and senior years, the heads of departments and the Office of the Dean of students take over primary responsibility for the students' personal and scholastic welfare.

The Office of the Dean of Students is open to all undergraduates at all times to assist the student in attaining his academic objective, and to assure his active, enjoyable participation in the work and affairs of the Institute.

The Placement Office functions as a natural outgrowth of the undergraduate guidance program. This office endeavors to keep Institute graduates in constant contact with the latest developments in the textile and allied industries, so that they may place themselves in positions best suited to their talents and abilities.

TUITION AND FEES

Tuition Fee.—The fee for the day course is $150 per year for residents of Massachusetts, and $250 per year for non-residents. The fee for students from foreign countries is $500 per year.

One-half of the fee is charged for a single term. Each term's tuition is payable during the first week of that term. Students failing to make this payment at the specified time will be excused from classes until satisfactory explanation and arrangements for payment can be made. No report of a student's standing will be mailed unless tuitition and fees are fully paid. After payment is made no fee or part thereof can be returned, except by special action of the trusteees. The above fee includes free admission for any day studnts desiring to attend any of the evening classes in which there is accommodation.

Special students pay, in general, the full fee, but if a course be taken involving attendance at the school during a limited time, application may be made to the President for a reduction.

Students entering from Massachusetts are required to file with the Bursar a statement signed by either town or city clerk, stating that the applicant's father is a legal resident of Massachusetts.

Student Activity Fee—A student activity fee of $25.00 is due and payable at the time of the first payment of tuition. This fee combines the former athletic and publication fees and helps support general student activities under the jurisdiction of the Student Council.

Deposits—Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Books and Materials—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments or other property of the Institute are loaned to the students to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Dormitory Rate Per Year	275
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50

Student Activity Fee	25
Machine shop deposit	10
General breakage fee	10
(This applies to students who do not take chemistry or machine shop)	
Books and supplies	50
(Books and supplies for the first year cost about \$80, second and third year \$35, and fourth year \$50, thus averaging about \$50 per year for the four years.)	
Late registration fee	5

STUDENT SCHOLARSHIPS

SCHOLARSHIPS:—A limited number of scholarships is available to students of Lowell Textile Institute through funds contributed by various companies representing the textile or allied industry.

A. Administered by the Committee on Scholarships

1. *Chicopee Scholarships—sponsored by the Chicopee Manufacturing Corporation*

Two scholarships may be awarded annually to selected sophomores in the courses of Textile Engineering or Cotton Yarn Manufacturing. Each scholarship pays the recipient $600 per academic year for residents of Massachusetts or $700 per academic year for out-of-state residents and the awards are for each of the junior and senior years. Candidates must be native-born citizens of the United States with potentialities for both leadership and scholarship. Preference is given to natives of New England and the recipient is expected to work in an approved cotton mill during the summer periods.

2. *Fiberglas Scholarships—sponsored by the Owens-Corning Fiberglas Corporation*

This scholarship is awarded annually to an outstanding sophomore in any of the textile courses. It pays the recipient full tuition and $500 per academic year for each of the junior and senior years. Selection is based upon academic record, character, qualities of leadership and need.

3. *Russell L. Brown Scholarship—donated by Davis and Furber Machine Company*

Open to a student acceptable to Lowell Textile Institute who plans to enroll in the curriculum of Textile Engineering or Wool Yarn Manufacturing. Preference given to employees and sons or grandsons of employees of Davis and Furber Machine Company. Selection based on general scholarship, initiative and need. Stipend $300. Appointments are for one year only but renewable.

Application should be filed with the Dean of Faculty not later than February first.

B. Administered by the agency designated

1. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Association make available several scholarships a year which cover tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

2. *Berkshire Fine Spinning Associates, Inc. Scholarships*

A number of scholarships covering tuition and living expenses for four years are offering in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employees of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

3. *Goodall-Sanford, Inc. Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Suc-

cessful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

Application should be made to Goodall-Sanford, Inc., Scholarship Committee, Sanford, Maine.

4. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination to students who qualify for entrance to Lowell Textile Institute under the terms described in the ADMISSION section of this Bulletin. All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1951. Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

5. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Association selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

6. *United Elastic Corporation Scholarships*

Scholarships in the amount of $150 are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. Other residents of the communities where plants are located, however, may enter applications for consideration. Preference is given to native New Englanders and to those who agree to work summers in approved mills.

Qualifications for scholarships include: good character and standing in the community, aptitude for technical training, and ability to pass entrance requirements of Lowell Textile Institute and/or with the approval of the United Elastic Corporation and the Lowell Textile Institute, scholarships may be awarded to deserving upperclassmen.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following graduation.

All applications should be made through the plant nearest to residence of applicant. Plants are located at Easthampton, Lowell and Littleton, Massachusetts, West Haven, Connecticut, and Stuart, Virginia.

A. Open only to graduates of Lowell Textile Institute

1. *Lowell Textile School Fellowship—sponsored by the Proprietors of the Locks and Canals on the Merrimack River.*

Pays tuition for graduate work at Massachusetts Insttute of Technology.

2. *Textron Fellowship—sponsored by Textron, Inc.*

Annual stipend of $1800 to $2400. Recipient may elect to do graduate work or take one year of practical training in representative mills of the textile industry. Application should be made to the Scholarship Committee of Lowell Textile Institute.

B. Open to graduates of textile schools

1. *Chicopee Manufacturing Corporation Fellowship*

Stipend: $1200. For graduate work at Massachusetts Institute of Technology.

2. *New England Textile Foundation Graduate Fellowship*
Stipend: $1000 plus tuition. For graduate work at Massachusetts Institute of Technology

3. *Textron Fellowship*
Stipend: $1200. For graduate work at Massachusetts Institute of Technology.

Further information on these three fellowships is given in the catalog of Massachusetts Institute of Technology.

Loan Fund:—A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning six months after the date at which the student officially leaves school. Repayments are not required until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $5.00 per quarter the first year and $10.00 per quarter each year thereafter until the loan is repaid.

Additional payments may be made at any time so as to reduce indebtedness at a more rapid rate.

STUDENT AWARDS

The following awards are given annually:

1. *The Cotton Medal:*—given by the National Association of Cotton Manufacturers to that member of the graduating class in the courses of Textile Engineering (General Option) or Cotton Yarn Manufacture who has maintained the highest scholastic standing throughout the four years of his undergraduate work.

2. *Book Prize:*—given by the American Association of Textile Chemists and Colorists to that member of the graduating class who maintains the highest standing throughout his course in Chemistry and Textile Coloring. The award includes also a junior membership in the A.A.T.C.C. for one year.

3. *Louis A. Olney Book Prizes:*—Prizes in the form of books are awarded each year on graduation day to the successful candidate. The conditions in detail are as follows:

$20 to the regular student of the Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship during his third year.

$15 to the regular student of the Chemistry and the Textile Coloring course who shall be considered as having attained the highest scholarship during his second year.

$15 to the student taking the regular Chemistry and Textile Coloring course who shall be considered as having attained the highest scholarship in first-year Chemistry.

4. *Phi Psi Award:*—This award is given annually to an outstanding member of the Senior Class on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

The award is a pocketbook and leather case set made of ostrich leather and lined with calfskin. Inside each article is embossed the coat of arms of the Phi Psi Fraternity, also the recipient's name printed in gold. In addition, the graduating student receiving this award is presented with a suitably engraved certificate.

M.I.T.-L.T.I. COOPERATIVE PLAN

A cooperative plan of operation between these two institutions has been agreed upon. The major provisions include: (1) the mutual use of the facilities for research and manufacturing in Lowell Textile Institute and the Massachusetts Institute of Technology, Textile Division, for student theses, both graduate and undergraduate; (2) the mutual use of the textile libraries of both institutions; (3) the opportunity, open to students in each institution, to supplement their education by taking work available in the other; (4) the formation of joint seminars and the exchange of staff members for special lectures; and (5) frequent student visits and joint meetings of student societies.

STUDENT LIFE

It is the general policy of the Faculty and Administration of the Institute to encourage extra-curricular activities. It is recognized that any sound educational program must seek to educate the whole personality of the student, so every effort is made to develop a wide choice of activities to supplement the purely academic interests of the undergraduate.

The Student Council is the over-all governing group charged with the responsibility of representing the student body. The Council is made up of members elected by each of the four classes, and the Council functions in accordance with the specific prescriptions of its Constitution and By-laws. Its duties vary from the investigation of grievances to sponsorship of All-Textile dances, banquets, and other social events. The Council has general supervision over the spending of the unallocated portion of the Student Activity Fee.

The Athletic Association promotes an extensive inter-collegiate and intramural sports program. All students, by virtue of payment of the Student Activity Fee are members of the Athletic Association and thereby receive free admission to all intercollegiate contests played at home. Football, basktball, and baseball are played on an intercollegiate level with teams throughout the Northeast. Golf, soccer, lacrosse, and ski teams, also, are sponsored by the Athletic Association and compete regularly with the squads fielded by other colleges. The Director of Intra-mural Athletics supervises the functioning of a lively informal competition between groups from different classes, dormitories, and fraternities.

Four fraternities are organized and are located in their own quarters close to the campus; they are: Delta Kappa Phi, Omicron Pi, Phi Psi, and Pi Lambda Phi. These fraternities are co-ordinated through the operation of the Inter-fraternity Council. Phi Sigma Rho is the girls' sorority.

Tau Epsilon Sigma is the scholastic honor society. Only seniors, who have maintained a high scholastic average for their first three years, are eligible for membership.

The student newspaper is called "The Text." It is published bi-weekly by the students and offers excellent journalistic experience to interested students. "The Pickout" is the annual yearbook published by the undergraduates; like "The Text" it is financed by the publications allotment from the Student Activity Fee.

The following clubs are prominent in the extra-curricular life of the Institute:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. Engineering Society
3. Glee Club
4. International Club for foreign students
5. Orchestra
6. Rifle Club, which participates in intercollegiate matches
7. Textile Players, the dramatic club

In addition to the above-mentioned formally organized clubs, there are numerous informal groups which energetically promote social, political, and intellectual activities; among these are the Bridge Club, the Student Discussion Group, and the Sportsmen's Club.

STUDENT RULES AND REGULATIONS

Students are admitted to Lowell Textile Institute on the assumption that they are gentlemen and of sufficient maturity to conduct themselves accordingly. The regulations are not framed for the purpose of restricting the conduct or accomplishments of any individual or group of students, but are intended to set forth the requirements of the faculty to the end that a large student body may live and work harmoniously together with a minimum of friction and misunderstanding. The rules are not comprehensive and a student may be dropped from the rolls or subjected to other disciplinary action, for conduct which is illegal, immoral, or inimicable to the best interests of the Institute, regardless of whether or not the particular offense is listed in these rules and regulations.

Attendance.—Attendance is expected of all students at all classes. Unexcused absences, and particularly absences immediately before and immediately after holiday and vacation periods, are subject to disciplinary action by the Dean of Students.

Discipline.—Disciplinary action originates in the office of the Dean of Students, and may fall within any of the following degrees of severity: censure, restriction, suspension, and dismissal.

Late registration for classes is subject to a five dollar fine, unless accompanied by a medical or equally acceptable excuse.

Grades.—The student's grade for a given subject is dependent upon the instructor's interpretation of the student's work. Upon the completion of the semester, the instructor will assign a letter grade to the student on the following basis:

90-100, H; equivalent to 5 points

80-89, C; equivalent to 4 points

70-79, P; equivalent to 3 points

60-69, L; equivalent to 2 points

50-59, F; (Conditional fail) equivalent to 1 point

Below 50, FF; (Unconditional fail) equivalent to 0 points.

The student's semester rating is a weighted value used to denote his relative standing. It is dependent upon the point value equivalent to his final grade and the credit hours allotted to the subject. To compute, the point value for the subject is multiplied by the credit hours for that subject. This is done for each subject. These calculated values are then summed up and this total is then divided by the total credit hours. The value so obtained is the student's semester rating.

Reports of scholastic progress or failure are compiled regularly at the end of each semester. Mid-semester grades in some courses are submitted to the office of the Dean of Students for guidance purposes, but formal notification of each student's status is made only at the conclusion of each semester.

The Dean's List.—The Dean's List is a roster of those students who have a semester rating of 4.0 or higher, with no current failures.

Probation.—A student is placed on probation when his semester rating is below 2.26. The probationary period constitutes the entire semester following the issuance of the semester rating which placed the student on probation.

A student who is on probation for two consecutive semesters will automatically be dropped from the rolls of the Institute.

A student on probation may not represent the Institute in any public function, and may not hold class or other offices which will require a significant portion of his time, without the specific consent of the Dean of Students.

If, at any time, a student receives a semester rating below 1.00, he may automatically be dropped from the Institute without benefit of a probationary period.

Requirements for Graduation.—In order to receive the degree at the end of the four-year program, a student must conform to the following requirements:

1. Maintain a minimum 2.50 cumulative point average.
2. Evidence no failures in the courses taken in the major department.
3. Complete the prescribed curriculum with no substitutions for subjects in the major department.
4. Offer acceptable, equivalent substitutions for any permanent failures. In this regard, substitutions taken either at Lowell Textile Institute or at any recognized collegiate institution, must be in an area of learning identical to the subject(s) failed.

PLACEMENT OFFICE

The Institute maintains a central placement office which has three functions:

1. To assist in the placement of graduating students.

2. To assist in the up-grading of alumni and/or to help each alumnus attain a position yielding a maximum of satisfactory and happiness.

3. To assist industry in the increasingly difficult job of locating trained and experienced personnel.

The Placement Office is concerned solely with positions affecting the graduating student; it does not attempt to place undergraduates in part-time or summer employment.

THE CO-OPERATIVE EDUCATION PLAN

In 1948, Lowell Textile Institute, formally adopted the Co-operative Plan of Education, on a voluntary basis, wherein those students electing the plan, and who pass the competitive selection process successfully, spend three summers in the textile industry on a planned work-study basis.

Work opportunities are available to a limited number of students, beginning at the end of the freshman year and continuing each summer thereafter until graduation. It is the aim of this program to give to participating students certain educational experiences that cannot be obtained in school and yet which are vital to the background of the technically trained college graduate, such as contact with machines and people in a production environment; development of an awareness of jobs and the impact of mass production methods on the personality of labor; knowledge of the interplay of the different fields of study covered in school in the successful operation of business. It is also hoped that by working in the industry early enough in his career, the student can judge more clearly and more thoughtfully whether or not he has been wise in choosing a textile career.

The manner in which the plan operates is fully described in a separate bulletin, which is available on request.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry, Master of Science in Textile Engineering, and Master of Science in Textile Manufacturing to graduate students who satisfactorily complete a program of advanced standing.

The object of these programs is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their undergraduate field, supplemented by work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees from other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance into the textile industry.

1. General Admission

An applicant for admission as a Graduate Student must present evidence that he is the holder of a Bachelor's degree in an acceptable four-year course in the pursuance of which he maintained a uniformly high scholastic rating. He must also be prepared to submit statements, from persons qualified to judge, that in their opinion he has the ability to pursue graduate work. *Applications for admission to the Graduate School should be made to the Registrar and filed no later than April 15.*

II. As a Provisional Graduate Student

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfies the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a Graduate Student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 3.5 (80%).

III. Requirements for Graduation

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

a. Completed a course of study approved by the department in which he has been enrolled.

b. Completed a thesis (original research or other investigation, optional with department) approved by the department in which he has been enrolled.

c. Residence of at least one academic year.

d. An average rating of 3.5 (80%) in those subjects submitted for graduate credit. Those subjects submitted for graduate credit, which are normally upperclass undergraduate subjects (those offered to juniors and/or senior students) must be passed with a grade of 80% or better.

The exact nature of each student's program will be worked out in cooperation with the major professor and approved by the Head of Department. Every attempt will be made to keep such programs flexible and in keeping with the student's educational objectives.

A graduate of Lowell Textile Institute, or one with equivalent training, can usually complete the work for the Master's degree in one year, provided he continues his major studies in the same field in which he majored as an undergraduate. Other students, or those who change their educational emphasis,

will require a longer time, usually two years, according to the number of prerequisite subjects whch must be taken.

Special work may be done in the Graduate School, by arrangement with the Graduate School Committee, by individuals not seeking an advanced degree, but who wish to take special subjects or to conduct research to which the facilities at Lowell Textile Institute may be peculiarly adapted. Candidates seeking such status must meet the requirements for General Admission to the Graduate School, as noted above.

Comparator Microphotometer

COURSES FOR THE BACHELOR OF SCIENCE DEGREE

Lowell Textile Institute offers ten curricula options, all leading toward the B.S. degree. A student chooses the desired option at the conclusion of the first semester of the freshman year and begins to specialize during the second semester of the freshman year. All curricula are sufficiently broad in educational scope during the first two years to permit a student to alter his initial choice of curriculum with a minimum of lost time, should a new objective become desirable.

A detailed program of each of these curricula is given in tabular form on the following pages. Shown for each semester are the subjects required; the lecture-recitation and laboratory hours and the credit toward graduation assigned to each subject; and the totals of both the credits and contact hours per week. In general, one credit represents one hour of lecture-recitation work or approximately three hours of laboratory work. A more detailed description of each subject offered at Lowell Textile Institute may be found in the section of this Bulletin entitled "SUBJECT DESCRIPTIONS", wherein the subject fields are listed alphabetically and may be found by referring to the same subject number designations shown in the tables below.

First Year. First Semester (Common to All Courses)

			Contact Hours	Credit Hours
Chem.	101	General Inorganic Chemistry	4-3	5
Eng.	111	Engineering Drawing	0-6	2
Engl.	101	English Composition and Literature	3-0	3
Math.	101	College Mathematics	4-0	4
Phys.	101	Physics	4-1	4½
Tex.	101	Survey of Textiles	2-0	1
		or		
Lea.	101	Survey of Leather	1-0	0
		or		
Paper	101	Survey of Paper	1-0	0
		Physical Education	0-2	0
			28-29	18½-19½

COURSE 1.—COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or of textiles produced from any staple fiber utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to process rayon, wool, and other staple fibers is considered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cotton	201-202	Cotton Carding	3-6	5	3-6	5
Cotton	211	Cottons	1-1	1½	—	—
Cotton	222	Cotton Waste Processing	—	—	1-1	1½
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Des.	262	Color	—	—	1-1	1
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	211-212	Weaving	2-2	2½	2-2	2½
Engl.	222	Appreciation of Literature				
or		or				
Soc. Sci.	212	World History	—	—	3-0	3
			29	21	28	19

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chem.	2-0	2	1-3	2
Cotton	301	Cotton Spinning	2-5	4	—	—
Cotton	302	Cot. Winding and Twisting	—	—	2-10	5
Cotton	311	Staple Fiber Manufacture .	1-1	1½	—	—
Cotton	322	Cotton Quality Control .	—	—	1-0	1
Des.	223	Fabric Design and Analysis .	2-1	2	—	—
Eco.	201-202	Economics	3-0	3	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
			29	21	30	18½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cotton	401	Mill Organization . .	4-0	4	—	—
Cotton	402	Management Problems .	—	—	2-0	2
Eco.	351	Textile Marketing . .	2-0	2	—	—
Eco.	412	Industrial Management .	—	—	4-0	4
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English . . .	—	—	1-0	1
Finish	421-422	Cotton and Synthetic Fin. .	2-3	3	2-3	3
Knit.	401	Knitting	2-5	4	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Elective			3 to 12	3-4	3 to 9	2-3
			24-33	19-20	21-28	18½-19½

COURSE II—WOOL MANUFACTURE

The course in Wool Manufacturing is planned for students who contemplate a career in the industries utilizing the wool fiber, or using the woolen, worsted, or felt systems of machinery to process fibers of any type. The student studies all fibers and all basic processing systems, but emphasis is given to the wool fiber and its manufacture.

The purpose of the Wool Manufacturing course is to train students for executive positions in any of the branches of the wool industry. It is planned for those who are chiefly interested in the production and processing phases. A thorough engineering and scientific background is part of the course in order to enable the student to better understand the application of engineering principles as applied to both textile machines and processes.

A maximum amount of time is devoted to the professional or textile subjects. Laboratory experiments are planned to train the student in the method of analyzing machines, as well as tests, settings, adjustments and the elimination of faulty work. With wool now being manufactured on cotton machinery, a study in Survey of Cotton Manufacture is offered in order that the student may know the similarities and differences of the wool and cotton systems. Synthetic fiber processing in the woolen and worsted systems is studied and laboratory work includes the actual processing of staple rayon and other manufactured fibers alone or blended with wool. Courses in Economics, Speech, Business Administration, Labor Problems, etc. are offered to better prepare the student to assume a position of responsibility and leadership, both in the industry and in his community.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	232	Fabric Design and Analysis	—	—	2-1	2
Eng.	212	Heat and Power	—	—	2-2	3
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	211-212	Weaving	2-2	2	2-2	2
Wool	211-212	Top Making	2-6	5	2-6	5
Engl.	222	Appreciation of Literature or				
Soc. Sci.	212	World History	—	—	3-0	3
			26	19	27	19

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Cot.	331	Cotton Yarn Manuf. Survey	3-1	3	—	—
Des.	233	Fabric Design and Analysis	2-1	2	—	—
Des.	272	Color	—	—	1-1	1
Eco.	201-202	Economics	3-0	3	3-0	3
Eco.	351	Textile Marketing	2-0	2	—	—
Tex.	302	Fabrics	—	—	2-0	2
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Wool	301-302	Woolen Yarns	2-4	3½	2-4	3½
Wool	321-322	Worsted Yarns	3-3	4	3-5	5
			30	22	29	19

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Eng.	422	Tex. Process Instrumentation	—	—	0-2	2
Engl.	201	Speech	2-0	2	—	—
Engl.	211	Business English	1-0	1	—	—
Fin.	401-402	Wool and Worsted Finishing	2-3	3	2-3	3
Knit.	401	Knitting	2-5	4	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Wool	412	Woolen and Worsted Mill Organization	—	—	4-0	4
			25	19	24	20½

COURSE III—TEXTILE DESIGN

The prescribed curriculum of the Textile Design Course is especially planned to equip the student with the fundamentals of structural textile design. This type of designing of textiles is concerned with the building of a fabric. To this end the student should become fully conversant, through lectures and laboratory work, with the properties of natural and synthetic fibers; the different systems of yarn manufacture; various arrangements of yarns in fabrics; the methods used to execute designs in woven and knitted fabric; dyeing; the various finishing processes employed after fabrication; and, the methods used for testing fabrics.

Emphasis is placed on subjects dealing with the analysis and designing of fabric structures, from the simplest plain fabric to the more complicated and elaborate. Such subjects as color, perspective, freehand drawing, and decorative design are included to extend somewhat the structural design thinking toward artistic expression in fabrics. The broad scope of this curriculum provides, in addition to the more specific structural design objectives, subjects in the sciences, liberal arts, and management.

The graduate of the Textile Design Course, though more specifically equipped as a structural textile designer, is qualified to enter into other branches of the textile industry according to his aptitudes and opportunities.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year—Second Semester

			Contact Hours	Crediit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Des.	102	Elementary Textile Design	2-1	2
Des.	104	Yarn Calculation	1-0	1
Des.	112	Handloom Weaving	0-3	1
Des.	122	Perspective	0-2	1
Des.	132	Freehand Drawing	0-2	1
Eng.	104	Mechanism	2-0	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Tex. Chem.	2-0	2	1-3	2
Des.	203-204	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	211-212	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	242	Decorative Design	—	—	0-2	1
Des.	251-252	Color	1-1	2	1-1	2
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	201-202	Weaving	2-4	3½	2-4	3½
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	—	—	3-0	3
			28	22½	30	21½

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Des.	301-302	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	311-312	Textile Design & Fabric Analysis	2-2	3	2-2	3
Eco.	201-202	Economics	3-0	3	3-0	3
Eco.	343	Accounting and Costing .	3-0	3	—	—
Eco.	351	Textile Marketing . .	2-0	2	—	—
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	302	Fabrics	—	—	2-0	2
Weav.	301-302	Weaving	2-4	3½	2-4	3½
Wool	312	Survey of Wool Manufacture	—	—	3-1	3
			26	20½	25	19

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Des.	401	Leno Fabric Design and Analysis	1-1	1½	—	—
Des.	402	Advanced Textile Design and Analysis	—	—	1-2	2
Des.	411-412	Jacquard Design and Weav. .	1-2	2	1-2	2
Eco.	412	Industrial Management .	—	—	4-0	4
Engl.	202	Speech	—	—	2-0	2
Engl	212	Business English . . .	—	—	1-0	1
Fin.	412	Woolen and Worsted Fin.	—	—	3-3	4
Fin.	431	Cotton and Synthetic Fin. .	3-3	4	—	—
Knit.	403	Knitting	2-3	3	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3
Tex.	311-312	Textile Testing . . .	2-2	3	2-2	3
Elective			3 to 9	3	—	—
			26-32	19½	26	21

COURSE IV—CHEMISTRY, TEXTILE COLORING AND FINISHING

This curriculum is designed to train those who wish to engage in the bleaching, scouring, dyeing, printing and finishing of textiles, or who are interested in the manufacture, demonstration and sale of dyestuffs, detergents and other chemicals used in the textile industry. Students having difficulty in color perception, while unfitted for employment in dyehouses or with dyestuff concerns, are capable of having a successful career in other branches of Textile Chemistry.

This course provides a basic training in chemistry, physics and mathematics. To this is added theoretical and practical training in bleaching, dyeing, printing and finishing, given in the junior and senior years. Since it is assumed that the students will eventually have executive or supervisory positions, they are required to take courses in English and Speech to provide a background for report writing and the expression of ideas. Courses in the humanities are also required in the hope that with a broader training the graduate will become a more valuable member of his community as well as a success in his chosen profession. German is offered students intending to study for advanced degrees.

This course leads to the degree of Bachelor of Science in Textile Chemistry.

First Year—Second Semester

			Contact Hours	Crediit Hours
Chem.	104	General Inorganic Chemistry . .	3-0	3
Chem.	122	Qualitative Analysis	3-6	5
Chem.	124	Elementary Stoichiometry . . .	2-0	2
Eng.	104	Mechanism	2-0	2
Engl.	102	English Composition and Literature .	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			27	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry . .	3-3	4	3-3	4
Chem.	204	Chem. Technology of Fibers	—	—	2-0	2
Chem.	211-212	Quantitative Analysis . .	1-6	3	1-6	3
Chem.	231	Library	1-0	1	—	—
Chem.	241-242	Stoichiometry . . .	1-0	1	1-0	1
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Engl.	211	Business English . . .	1-0	1	—	—
Math.	203-204	Mathematics for Chemists .	4-0	4	2-0	2
Phys.	201-202	Physics	3-2	4	3-2	4
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Wool	312	Survey of Wool Manufacture	—	—	3-1	3
			29	21	29	20½

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	311	Textile Quantitative Anal.	1-6	3	—	—
Chem.	321-322	Textile Chemistry	2-3	3	2-3	3
Chem.	331-332	Physical Chemistry	3-1½	3½	3-3	4
Chem.	362	General Colloid Chemistry	—	—	2-0	2
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Eco.	201-202	Economics	3-0	3	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Restricted Electives*						
Chem.	312	Textile Quantitative Analysis or	—	—	1-3	2
Chem.	342	Organic Qualitative Analysis				
Chem.	352	Chemical Engineering or	—	—	3-0	3
Ger.	202	Technical German				
Eng.	351	Experimental Applications of Statistics or	3-0	3	—	—
Ger.	201	Technical German				
			30½	21½	29	22

*If German is elected during the first semester, it must be continued throughout the year.

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	411-412	Advanced Textile Chemistry and Dyeing	2-9	5	2-9	5
Chem.	421	Advanced Chemical Textile Testing	2-3	3	—	—
Chem.	431	Textile Applications of Colloid Chemistry	2-0	2	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Engl.	202	Speech	—	—	2-0	2
Fin.	411	Woolen and Worsted Fin.	3-3	4	—	—
Fin.	432	Cotton and Synthetic Fin.	—	—	3-3	4
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Eco.	344	Principles of Selling and Advertising				
or		or	—	—	4-0	4
Eco.	412	Industrial Management				
Professional Electives			1 or 3	2	1-3	2
			31 or 33	21	30	20

COURSE V—SYNTHETIC TEXTILES

This curriculum is designed for students interested in those segments of the textile industry primarily devoted to the utilization of man-made fibers, with particular emphasis on continuous filament fibers. Silk, being a natural continuous filament fiber not covered in other manufacturing courses, is also considered.

The synthetic fiber phase of textiles is the most recent addition to the industry and found its origin in the various chemical research laboratories. Because of this, an understanding of the manufacture and utilization of synthetic fibers depends upon a sound training in chemistry, physics and mathematics. More emphasis is placed on chemistry than in the other manufacturing courses.

Realizing the importance of a broad college training for men entering the industry with the intention of eventually assuming some type of administrative position, specialization in textiles is limited to approximately forty percent of the total credit hour load. The remaining sixty percent of the studies are devoted to basic subjects, such as the fundamental physical sciences, English, the social sciences and economics. Within the broad field of specialization in textiles, about one-half of the time is devoted to synthetic fibers, yarns and textiles.

Graduates of this curriculum should be acceptable to the textile manufacturer, the synthetic fiber producer, and the graduate schools of the country.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year—Second Semester

			Contact Hours	Crediit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Syn.	102	Orientation in Synthetic Textiles	1-0	1
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			31	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Cot.	332	Cotton Yarn Manufacture Survey	—	—	3-1	3
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl. or Soc. Sci.	222 212	Appreciation of Literature or World History	—	—	3-0	3
			27	22	27	22

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Des.	303	Synthetic Fabric Design and Analysis	1-2	2	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Soc. Sci.	221	Economic History	3-0	3	—	—
Soc. Sci.	402	Industrial Relations Seminar	—	—	2-0	2
Syn.	301	Filament Yarn Processing	2-0	2	—	—
Syn.	302	Throwing Plant Organization	—	—	2-0	2
Syn.	311	Manufacture of Synthetic Fibers	3-0	3	—	—
Syn.	312	Structure and Properties of Synthetic Fibers	—	—	3-0	3
Syn.	331-332	Filament Yarn Laboratory	0-3	1	0-3	1
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	211-212	Weaving	2-2	2½	2-2	2½
			26	20½	28	21½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Fin.	432	Cotton and Synthetic Finishing	—	—	3-3	4
Knit.	403	Knitting	2-3	3	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Syn.	411-412	Properties and Applications of Synthetic Fibers	3-0	3	3-0	3
Syn.	452	Synthetic Textiles Seminar	—	—	2-0	2
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Free Electives			5 to 15	5	5 to 15	5
			23-33	19½	23-33	19½

COURSE VI—TEXTILE ENGINEERING

The concept of a textile engineer originated in 1905, and the first known curriculum in Textile Engineering appears in the Lowell Textile Institute catalog for 1905-06. Through the succeeding years the same general pattern has been followed in this training, modified from time to time, however, to recognize changing conditions in the industry and in educational ideas, but always embodying the same two fundamental foundations. A textile engineer is defined as one who has had a basic training in engineering to which has been added a thorough grounding in the manufacture of textiles, their properties and uses.

Two options are offered in Textile Engineering, viz., Engineering and General Manufacturing. It is the belief of the Engineering faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, e.g., chemistry, the ideal training for the textile industry combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, as well as an orientation to society and business through a selected core of liberal arts and economics subjects. Although the credit hour ratings, assigned to VI-E and VI-G are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

ENGINEERING OPTION—VI-E

The Engineering Option provides a training in Mechanical Engineering similar to that found in other engineering schools. To this is added a knowledge of Textiles sufficient to prepare the individual for positions in the textile and allied industries which may involve research and engineering principles. Business subjects and the humanities are included in the curriculum so that this type of textile engineer may have the educational potential to rise to a position of executive responsibility.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	332	Cotton Yarn Manufacture Survey	—	—	3-1	3
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	224	Fabric Design and Analysis	—	—	2-1	2
Des.	234	Fabric Design and Analysis	—	—	2-1	2
Eng.	201	Machine Drawing	0-3	1	—	—

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eng.	221	Textile Mechanism	1-2	1½	—	—
Eng.	222	Applied Mechanics	—	—	3-0	3
Eng.	233	Machine Tool Laboratory	0-3	1	—	—
Engl.	201	Speech	2-0	2	—	—
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	—	—	3-0	3
			28	19½	26	21½

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eco.	201-202	Economics	3-0	3	3-0	3
Eng	301-302	Advanced Applied Mechanics	3-0	3	3-0	3
Eng.	312	Heat Engineering	—	—	3-2	4
Eng.	331	Mill Engineering	3-0	3	—	—
Eng.	342	Principles of Electrical Engineering	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Engl.	212	Business English	—	—	1-0	1
Phys.	321	Electronics	3-2	4	—	—
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	333-334	Weaving	1-2	1½	1-2	1½
			24	20½	26	21½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Eng.	401	Principles of Electrical Engineering	3-2	4	—	—
Eng.	402	Textile Applications of Electricity	—	—	1-4	1
Eng.	411	Advanced Heat Engineering	2-2	3	—	—
Eng.	421	Engineering Design of Textile Structures	2-0	2	—	—
Eng.	422	Textile Process Instrumentation	—	—	2-0	2
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Knit.	404	Knitting	—	—	2-3	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Eng.	431	Advanced Physical Testing				
or		or	1-3	2	—	—
Phys.	401	Advanced Textile Microscopy				
Eng.	424	Machine Design			2-2	
or		or	—	—		3
Phys.	402	Advanced Textile Physics			2-3	
or		or				
Math.	502	Differential Equations			3-0	
			27	21	28-30	20

GENERAL MANUFACTURING OPTION—VI-G

The objective of the General Manufacturing Option is to provide the textile industry with technically trained textile engineers. The curriculum has been planned so that the textile engineer (1) shall be given as complete and thorough a knowledge and understanding of the raw materials, machines, and processes peculiar to the manufacture of all fibers as is possible; (2) shall have a basic training in mechanical engineering, and the fundamental sciences and (3) shall acquire a knowledge of business principles and the social sciences.

The first objective should prepare the student to be useful in any textile plant regardless of fiber processed. The second should develop a man who will approach textile problems from an engineering viewpoint thus contributing toward their solution the benefits of a trained analytical mind. The third objective should aid in the production of a well rounded individual.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Cot.	203-204	Cotton Carding	3-2	4	3-2	4
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	224	Fabric Design and Analysis	—	—	2-1	2
Des.	234	Fabric Design and Analysis	—	—	2-1	2

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
Weav.	221-222	Weaving	2-0	1½	2-0	1½
Wool	215-216	Top Making	2-2	3	2-2	3
			25	20½	29	21½

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	303	Cotton Spinning	2-2	3	—	—
Cot.	304	Cotton Winding and Twisting	—	—	2-2	3
Eco.	201-202	Economics	3-0	3	3-0	3
Eng.	321	Strength of Materials	3-0	3	—	—
Eng.	344	Electrical Machinery	—	—	3-2	4
Phys.	321	Electronics	3-1	3½	—	—
Tex.	241	Library	1-0	1	—	—
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	321-322	Weaving	2-0	1½	2-0	1½
Wool	323-324	Woolen Yarns	2-2	2½	2-2	2½
Wool	325-326	Worsted Yarns	3-2	3½	3-2	3½
			30	24	29	22½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	401	Mill Organization	4-0	4	—	—
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Eng.	311	Principles of Heat Engineering	3-2	4	—	—
Eng.	402	Textile Applications of Electricity	—	—	1-4	1
Eng.	422	Textile Process Instrumentation	—	—	2-0	2
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Knit.	404	Knitting	—	—	2-3	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Eng. or Phys.	431 or 401	Advanced Physical Testing or Advanced Textile Microscopy	1-3	2	—	—
			27	22	30	21½

COURSE VII—TEXTILE SALES

This course is designed for those interested in the marketing and merchandising of textile and allied products. Its emphasis is on training in all phases of management, particularly as applied to the distribution of textiles. In addition, the student is given a fundamental knowledge of the natural sciences and their application to the processing of all types of textile fibers. This scientific and manufacturing background is increasingly essential to effective selling, merchandising and management of distribution, particularly at the higher levels of supervision. A substantial amount of time is also devoted to cultural subjects designed to broaden the student's outlook, increase his understanding of social and economic problems, and improve his ability to get along with people.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Eng.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Des.	251-252	Color	1-1	2	1-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Soc. Sci.	222	Man and his Environment	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl.	222	Appreciation of Literature or				
Soc. Sci.	212	World History	—	—	3-0	3
			25	22	25	20½

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Des.	223	Fabric Design and Analysis	2-1	2	—	—
Des.	232	Fabric Design and Analysis	—	—	2-1	2
Eco.	311	Economic Statistics	3-0	3	—	—
Eco.	321-322	Principles of Marketing	3-0	3	3-0	3
Eco.	344	Principles of Selling & Advertising	—	—	4-0	4
Engl.	201	Speech	2-0	2	—	—
Engl.	212	Business English	—	—	1-0	1
Soc. Sci.	311	Psychology	3-0	3	—	—
Soc. Sci.	312	Sociology	—	—	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	333-334	Weaving	1-2	1½	1-2	1½
			25	20½	23	19½

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Des.	233	Fabric Design and Analysis	2-1	2	—	—
Eco.	341-342	Principles of Accounting	3-0	3	3-0	3
Eco.	412	Industrial Management	—	—	4-0	4
Eco.	421	Foreign Trade	3-0	3	—	—
Eco.	431-432	Selling Policies	3-0	3	3-0	3
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Electives			2-4	2-3	4-6	3-4
			23-25	20-21	23-25	20-21

COURSE VIII—PAPER ENGINEERING

The object of this course is to fit a man for work in the paper making, paper converting or allied industries. For this a thorough training in basic chemical engineering is offered, accompanied by instruction in the theory and practice of pulp and paper manufacture and paper converting. Paper engineering involves the application of cellulose and plastics chemistry together with engineering principles to the handling of the material in the web or sheet form, as it is treated, coated or converted into the final product. Every effort will be made by cooperation with local concerns to supplement college work by experience in actual manufacturing conditions, thus giving the student an opportunity to familiarize himself with equipment commonly in use in the industry.

Students taking this course should be well equipped for work in the paper making or paper converting fields or for graduate study in paper technology.

The curriculum outlined below should be regarded as provisional in character.

This course leads to the degree of Bachelor of Science in Paper Engineering.

First Year—Second Semester

		Contact Hours	Credit Hours
Chem. 102	General Inorganic Chemistry	3-3	4
Chem. 112	Qualitative Analysis	2-3	3
Chem. 124	Elementary Stoichiometry	2-0	2
Eng. 112	Engineering Drawing	0-6	2
Engl. 102	English Composition and Literature	3-0	3
Math. 102	College Mathematics	4-0	4
	Physical Education	0-2	0
		28	18

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Chem.	213	Quantitative Analysis	2-6	4	—	—
Chem.	231	Library	1-0	1	—	—
Eng.	104	Mechanism	—	—	2-0	2
Eng.	122	Machine Tool Lab.	—	—	1-2	1
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Math.	203-204	Mathematics for Chemists	4-0	4	2-0	2
Paper	201-202	Pulp and Paper Manufacture	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
			27	20	24	19

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	331-332	Physical Chemistry . .	3-1½	3½	3-3	4
Chem.	333	Industrial Stoichiometry	3-0	3	—	—
Chem.	352	Chemical Engineering . .	—	—	3-0	3
Chem.	362	General Colloid Chemistry	—	—	2-0	2
Eng.	342	Principles of Electrical Engineering . . .	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Paper	302	Pulp and Paper Manufacture	—	—	3-0	3
Paper	303	Wood Technology . . .	3-3	4	3-0	3
Paper	312	Pulp and Paper Testing and Analysis	—	—	4-7	6
Phys.	321	Electronics	3-1	3½	—	—
Soc. Sci.	221	Economic History . . .	3-0	3	—	—
			23½	20	30	22

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	442	Advanced Chemical Engineering	—	—	3-0	3
Eng.	401	Principles of Electrical Engineering	—	—	3-2	4
Paper	401	Practical Work in Industry	—	18	—	—
Paper	403	Materials of Construction. Corrosion	—	2	—	—
Paper	404	Paper Coating and Converting	—	—	3-0	3
Paper	412	Industrial Cellulose Esters .	—	—	1-0	1
Paper	414	Advanced Paper Problems .	—	—	2-6	4
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3
			—	20	23	18

COURSE IX—LEATHER ENGINEERING

The concept of a leather engineer is new to the leather industry. The economic size of this industry as well as the scope and number of its problems warrants the careful training of individuals capable of handling the specific problems which arise in this industry. The leather industry realizes that many of its products can be improved by the application of sound and intelligent research and development. The demand is growing for engineers having a basic understanding of the art of leather manufacturing.

In this curriculum, emphasis will be placed on the fundamentals of engineering, including mathematics, physics, chemistry and theoretical and applied mechanics. These subjects are basic in any sound undergraduate program. Since the undergraduate student cannot be left with a great collection of tools which he does not understand, subjects are offered in the application of these basic scientific principles to leather technology. In order to properly balance this program, subjects in general education are offered, since the engineer as well as being trained to be a leader in his profession must also be trained to be a leader in the everyday economic, social and political affairs. He must also be trained to meet success, promotion and the challenge of directing the work of others.

The curriculum outlined below should be regarded as provisional in character.

This course leads to the degree of Bachelor of Science in Leather Engineering.

First Year—Second Semester

			Contact Hours	Credit Hours
Chem.	104	General Inorganic Chemistry	3-0	3
Chem.	112	Qualitative Analysis	2-3	3
Chem.	124	Elementary Stoichiometry	2-0	2
Eng.	104	Mechanism	2-0	2
Eng.	112	Engineering Drawing	0-6	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
		Physical Education	0-2	0
			27	19

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Chem.	213	Quantitative Analysis	2-6	4	—	—
Eng.	201	Machine Drawing	0-3	1	—	—
Eng.	222	Applied Mechanics	—	—	3-0	3
Engl.	201	Speech	2-0	2	—	—
Engl.	212	Business English	—	—	1-0	1
Ger.	201-202	German	3-0	3	3-0	3
Lea.	202	Applied Leather Analysis	—	—	1-6	3
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
			30	21	28	21

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	331-332	Physical Chemistry . .	3-1½	3½	3-3	4
Chem.	335	Chemistry of the Proteins	3-0	3	—	—
Chem.	362	General Colloid Chemistry	—	—	2-0	2
Eco.	412	Industrial Management .	—	—	4-0	4
Eng.	321	Strength of Materials . .	3-0	3	—	—
Lea.	301-302	Leather Manufacture . .	3-6	5	3-6	5
Lea	303	Histo-Pathology of Animal Tissues	1-6	3	—	—
Lea.	304	Microscopy in Tanning . .	—	—	1-3	2
Lea.	322	Tanning Mechanisms . .	—	—	3-0	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
			29½	20½	28	20

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eco.	343	Accounting and Costing .	3-0	3	—	—
Eco.	468	Corporation Finance . .	—	—	3-0	3
Eng.	344	Electrical Machinery . .	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Eng.	424	Machine Design	—	—	2-2	3
Lea.	401-402	Leather Manufacture . .	3-6	5	3-6	5
Lea.	404	Properties of Leather . .	—	—	2-3	3
Lea.	411-412	Leather Problems . . .	1-6	3	1-6	3
Phys.	321	Electronics	3-1	3½	—	—
Soc. Sci.	463	Business Law	3-0	3	—	—
			29	20½	33	21

SUBJECT DESCRIPTIONS

1. First semester subjects are those ending in odd numbers.

2. Second semester courses are indicated by even numbers.

3. Subjects continuing throughout the year are indicated by hyphenated numbers.

4. The number of lecture-recitation and laboratory hours is indicated within the parentheses and the credit is shown outside. In the case of a year course, the credit shown is the total for the year. Example: (2-6)4 would means 2 hours of lecture-recitation and 6 hours of laboratory for 4 credits; while a year course (2-3) (1-6)6 would indicate 2 hours of lecture-recitation and 3 hours of laboratory for the first semester followed by 1 hour of lecture-recitation and 6 hours of laboratory the second semester, for a total credit of 6.

5. The prerequisites for various subjects are shown. In exceptional cases, the Head of the Department may waive a prerequisite requirement by notifying in writing the Registrar of such action.

6. Subjects numbered 100-199 are normally given at the freshman level.
   Subjects numbered 200-299 are normally given at the sophomore level.
   Subjects numbered 300-399 are normally given at the junior level.
   Subjects numbered 400-499 are normally given at the senior level.
   Subjects numbered 500 and above are restricted to graduate students.
   No subject below 300 may be counted toward the Master of Science degree.

Subjects are Listed Alphabetically by Subject Classifications, Irrespective of the Department Involved.

A Laboratory at Lowell Textile Institute

CHEMISTRY

CHEM. 101 GENERAL INORGANIC CHEMISTRY (4-3)5
Required of all freshmen PROF. CHACE AND STAFF

This subject is concerned with the basic principles of chemistry and a consideration of non-metallic elements and their compounds.

CHEM. 102 GENERAL INORGANIC CHEMISTRY (3-3)4
Prerequisite: CHEM. 101 PROF. CHACE AND STAFF
Required of all freshmen except those in Courses IV and IX

In this subject, attention is focused on metals and their compounds. In the laboratory, special emphasis is placed on textile applications.

CHEM. 104 GENERAL INORGANIC CHEMISTRY (3-0)3
Prerequisite: CHEM. 101 PROF. CHACE
Required of freshmen in Courses IV and IX

In this subject, attention is focused on the metals and their compounds and a continuation of the studies of the basic principles is made.

CHEM. 112 QUALITATIVE ANALYSIS (2-3)3
Prerequisite: CHEM. 101 PROF. DALEY
Required in Courses VIII and IX

This subject covers the systematic qualitative analysis of inorganic compounds using semi-micro technique.

CHEM. 122 QUALITATIVE ANALYSIS (3-6)5
Prerequisite: CHEM. 101 PROF. DALEY
Required in Course IV MESSRS. BROWN AND LAVRAKAS

This subject covers the systematic qualitative analysis of inorganic compounds.

CHEM. 124 ELEMENTARY STOICHIOMETRY (2-0)2
Prerequisites: CHEM. 101, MATH. 101 PROF. DALEY
Required in Courses IV, VIII and IX MR. BROWN

The elementary calculations of inorganic chemistry and qualitative analysis.

CHEM. 201-202 ORGANIC CHEMISTRY (3-3)(3-3)8
Prerequisite: CHEM. 102 *or* 104 PROF. GLEGG
Required in Courses IV, V, VIII and IX MR. KELLEY

A study of the important classes of carbon compounds and the fundamental theories of organic chemistry.

CHEM. 204 CHEMICAL TECHNOLOGY OF FIBERS (2-0)2
Prerequisite: CHEM. 201 PROF. SKINKLE
Required in Course IV

A study of the chemical properties of the textile fibers and the resulting reactions with chemicals and dyes which are of technical importance. Both natural and artificial fibers are considered.

CHEM. 211-212 QUANTITATIVE ANALYSIS (1-6)(1-6)6
Prerequisite: CHEM. 122 PROFS. FICKETT AND JAMES
Required in Course IV

This subject covers the fundamental principles of quantitative analysis. The first semester emphasizes gravimetric analysis. Volumetric techniques are covered during the second semester.

CHEM. 213 QUANTITATIVE ANALYSIS (2-6)4
Prerequisite: CHEM. 112 PROF. JAMES
Required in Courses VIII and IX

This subject covers the common analytical operations of gravimetric and volumetric analysis and the calculations involved.

CHEM. 221 INTRODUCTION TO TEXTILE CHEMISTRY (2-0)2
Prerequisite: CHEM. 102 PROF. HOWARTH
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This subject is designed for the non-chemist and consists of a series of lectures covering the various processes preliminary to dyeing. The preliminary treatments given the natural and manufactured fibers are covered as well as the action and properties of the textile chemicals used in these processes.

CHEM. 222 INTRODUCTION TO TEXTILE CHEMISTRY (1-3)2
Prerequisite: CHEM. 221 PROFS. HOWARTH AND EVERETT
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This is a continuation of CHEM. 221. The application of the various classes of dyes to the natural and manufactured fibers is covered. The methods of dyeing, the fastness properties of the different classes of dyes and the nature and use of dyeing assistants is taken up. The principles covered in the lectures are illustrated by work in the laboratory.

CHEM. 231 LIBRARY (1-0)1
Prerequisite: CHEM. 104 MR. MASASCHI
Required in Courses IV and VIII

Lectures on the use of the literature and the methods of library classification with particular emphasis on the use of chemical and textile literature.

CHEM. 241-242 STOICHIOMETRY (1-0) (1-0)2
Prerequisite: CHEM. 124 PROFS. FICKETT AND JAMES
Required in Course IV

Calculations of gravimetric analysis are studied in the first semester; calculation of volumetric analysis, in the second semester.

CHEM. 311 TEXTILE QUANTITATIVE ANALYSIS (1-6)3
Prerequisite: CHEM. 212 PROFS. FICKETT AND JAMES
Required in Course IV

This subject is devoted to basic principles of chemical analysis covered in CHEM. 122 and 211-212 and to the examination of materials used in the textile mill, the dye house, and the finishing plant. Among the materials covered are water, oils, soaps, bleaching agents, etc.

CHEM. 312 or 313 TEXTILE QUANTITATIVE ANALYSIS (1-3)2
Prerequisite: CHEM. 311 PROFS FICKETT AND JAMES

This is a continuation of CHEM. 311. The analysis of such materials as vegetable, animal, lubricating and sulfated oils is considered.

CHEM. 321-322 TEXTILE CHEMISTRY (2-3) (2-3)6
Prerequisites: CHEM. 202, ENG. 104 *and* PHYS. 202
Required in Course IV PROFS. HOWARTH AND EVERETT

This subject is designed primarily for those majoring in chemistry and is the first of four semesters relating to the chemistry of all types of textile

fibers, i.e. cotton, wool, rayon, nylon, flax, etc. Among the major topics covered the first year are: (1) Operations preliminary to dyeing, (2) Water in the textile industry, (3) Theory of dyeing, (4) Coloring matters, (5) Dyeing processes.

CHEM. 331-332 PHYSICAL CHEMISTRY (3-1½)(3-3)7½
Prerequisites: CHEM. 104, MATH. 204 and PHYS. 202 — PROF. CHACE, MR. LISIEN
Required in Courses IV, VIII and IX

A study of the important principles of physical chemistry, i.e., gaseous, liquid, solid states; elementary chemical thermodynamics; determination of molecular weights; viscosity; surface tension; etc.

Topics covered include dilute solutions, chemical equilibrium, phase equilibrium, free energy and electrical properties of solutions.

CHEM. 333 INDUSTRIAL STOICHIOMETRY (3-0)3
Prerequisite: CHEM. 331 *taken concurrently* — PROF. BROUGHTON
Required in Course VIII

This comprises the study of some important operations in the chemical industry, e.g., sulfuric acid, and in the pulp and paper industry from the standpoint of the application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Recirculatory processes will also be studied.

CHEM. 335 CHEMISTRY OF THE PROTEINS (3-0)3
Prerequisites: CHEM. 202 *and* CHEM. 331 *taken concurrently* — PROF. CHOUINARD
Required in Course IX

A study of the chemistry of proteins with special emphasis on the collagen molecule.

CHEM. 342 ORGANIC QUALITATIVE ANALYSIS (1-3)2
Prerequisites: CHEM. 122 *and* 202 — PROF. GLEGG, MR. KELLEY

The purpose of this subject is to acquaint the student with the methods of the qualitative determination of unknown organic compounds.

CHEM. 352 CHEMICAL ENGINEERING (3-0)3
Prerequisites: CHEM. 104, MATH. 204 *and* PHYS. 202 — MR. MASASCHI
Required in Course VIII

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying, with special emphasis on textile application and textile chemical machinery.

CHEM. 362 GENERAL COLLOID CHEMISTRY (2-0)2
Prerequisite: CHEM. 331 — PROF. BROUGHTON
Required in Courses IV, VIII and IX

This subject covers the basic general principles of colloidal chemistry, followed by elementary analyses of important problems encountered in amorphous materials such as paints, cellulosic products, leather, paper and textiles.

CHEM. 411-412 ADVANCED TEXTILE CHEMISTRY AND DYEING (2-9)(2-9)10
Prerequisite: CHEM. 322 — PROFS. HOWARTH AND EVERETT, MR. PEIRENT
Required in Course IV

Continuation of CHEM. 321-322, covering (1) Color matching and color

combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, and (5) Dye house management.

CHEM. 414 SPECIAL STUDIES IN DYEING (1-6)3
Prerequisite: CHEM. 412 or *permission of instructor*
PROFS. HOWARTH AND EVERETT

A subject designed for those desiring more than the required work in dye application. Further work in dye application is given, also dye testing, color matching and textile printing.

If the student has a particular problem in the application of dyes, time will be allotted for its study.

CHEM. 421 ADVANCED CHEMICAL TEXTILE TESTING (2-3)3
Prerequisites: CHEM. 202, CHEM. 212 *and* TEX. 312
PROF. SKINKLE
MR. MASASCHI

A series of lectures and laboratory periods designed to supplement the textile testing given in TEX. 311-312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content and fiber damage is followed by some dyestuff identification. The use of optical equipment such as the colorimeter, pH apparatus, spectrophotometer, ultra violet radiation and infrared radiation is also studied.

CHEM. 431 TEXTILE APPLICATIONS OF COLLOID CHEMISTRY (2-0)2
Prerequisites: CHEM. 332 *and* CHEM. 362
PROF. SKINKLE
Required in Course IV

The principles of general colloid chemistry are applied to specific textile applications. Wetting, detergency, the fibers themselves, dyes, and finishing processes are studied from the colloidal aspect.

CHEM. 441 ADVANCED CHEMICAL ENGINEERING (3-0)3
Prerequisite: CHEM. 352
PROF. BROUGHTON
Required in Course VIII

An advanced study of the subjects covered in CHEM. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This is an elective continuation of CHEM. 352.

CHEM. 451-452 NATURAL AND SYNTHETIC HIGH POLYMERS (3-0)(3-0)6
Prerequisites: CHEM. 202, CHEM. 332, MATH. 204 *and* PHYS. 202
PROF. GLEGG

This presents the fundamental organic and physical chemistry of cellulose, rubber, wool and the various addition and condensation polymers. The main topics covered are (1) chemical structure; (2) physical structure; (3) orientation and fine structure; (4) molecular weight, molecular weight distribution, methods of determining molecular weight; (5) addition polymerization; (6) condensation polymerization; (7) the mechanical properties of high polymers and (8) the commercial uses of these substances.

An attempt is made to correlate the material so that an understanding of the behavior of high polymers in textile materials is developed.

CHEM. 461 or 462 MICROBIOLOGY (1-3)2
Prerequisite: CHEM. 202
PROF. CHACE
MR. BROWN

This subject considers the fundamentals of mycological and bacteriological

theory briefly but in sufficient detail so that the problem of the microbiological deterioration of textiles may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance are considered in the laboratory.

CHEM. 464 ADVANCED MICROBIOLOGY (1-3)2
Prerequisite: CHEM. 461 *or* 462 PROF. CHACE

This work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc. are typical.

CHEM. 471 ADVANCED INORGANIC CHEMISTRY (2-0)2
Prerequisite: CHEM. 332 MR. LAVRAKAS

This subject introduces the student to theories which are important in present-day chemistry. Such topics as the hydrogen bond, Werner's coordination theory, theories of acids and bases, particles as defined in modern physics, and the quantum theory are discussed.

CHEM. 472 INORGANIC PREPARATIONS (2-3)3
Prerequisite: CHEM. 104 PROF. CHACE

The purpose of this subject is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

CHEM. 491 APPLICATIONS OF MICROSCOPY (1-3)2
Prerequisite: TEX. 312 MR. MASASCHI

Lectures and laboratory work on the more advanced aspects of the applications of textile microscopy. Further work on fiber sectioning, fiber casts, and polarized light phenomena is done; also the various quantitative aspects of textile microscopy such as deconvolution count, wool grading, hair identification, and the quantitative analysis of fiber mixtures are considered.

CHEM. 501 or 502 APPLICATIONS OF COLOR MEASUREMENT
Credits and hours to be arranged PROF. SKINKLE
Prerequisite: CHEM. 421 *or equivalent*

This subject covers the description and use of transmission and reflection colorimeters and also the spectrophotometers and recording spectrophotometer. The calculations from the results are studied and the use of the instruments in dye application research is thoroughly investigated.

CHEM. 511 or 512 SURFACE ACTIVE AGENTS PROF. SKINKLE
Credits and hours to be arranged
Prerequisite: CHEM. 431

A laboratory study, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial applications.

CHEM. 521 or 522 TEXTILE TESTING PROBLEMS PROF. SKINKLE
Credits and hours to be arranged
Prerequisite: CHEM. 421

Special problems relating to the design and evaluation of improved analytical or testing procedures.

CHEM. 523 or 524 METHODS OF GROUP RESEARCH PROF. SKINKLE
Credits and hours to be arranged
Limited to 4-6 students

A series of conferences and laboratory periods utilized in carrying out a sample industrial research by the concerted action of the group. The problem is analyzed, its various parts distributed to individuals and the results combined by the group. The students alternate in supervising the work of the group.

CHEM. 525 or 526 EVALUATION OF FINISHING AGENTS
Credits and hours to be arranged PROF. SKINKLE

A laboratory study designed to teach the use of the various test methods and instruments in evaluating the effect of finishing treatments on the tactile and end-use properties of a fabric.

CHEM. 531-532 TEXTILE CHEMISTRY SEMINAR (2-0)(2-0)4
Prerequisite: Permission of Instructor PROF. SKINKLE

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

COTTON

COTTON 201-202 COTTON CARDING (3-6)(3-6)10
Prerequisite: ENG. 102 *or* ENG. 104 MR. POPE
Required in Course I

This is a study of the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing and roving. Considerable time is devoted to the studying of cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The basis of cotton classing is thoroughly covered here and the general background of how cotton is bought and sold is explained. The mill processes are studied in detail, using specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

COTTON 203-204 COTTON CARDING (3-2)(3-2)8
Prerequisite: ENG. 102 *or* ENG. 104 MR. POPE
Required in Course VI-G

This subject is similar to COTTON 201-202, but requires considerably less laboratory time. The subject is designed for those with a more general interest in textile manufacturing.

COTTON 211 COTTONS (1-1)1½
Prerequisites: COTTON 201 *taken concurrently,* ENG. 102 *or* 104 PROF. MERRILL
Required in Course I

This subject consists of lectures and laboratory work, supplementary to COTTON 201 for those students who major in cotton. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class.

COTTON 222 COTTON WASTE PROCESSING (1-1)1½
Prerequisite: COTTON 201 PROF. MERRILL
Required in Course I

For those specializing in Cotton Manufacture, this subject provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

COTTON 301 COTTON SPINNING (2-5)4
Prerequisite: COTTON 202 PROF. GOODWIN
Required in Course I

This subject is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning. Particular consideration is given to the production of yarns for different uses and to methods by which desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughly studied and problems are assigned for student practice.

COTTON 302 COTTON WINDING AND TWISTING (2-10)5
Prerequisite: COTTON 301 PROF. GOODWIN
Required in Course I

This subject is a continuation of the subject of spinning, in which the instruction covers the conclusion of spinning, spooling and the various types of winding, the twisting of common and fancy yarns, and such incidental features as reeling, baling, mule spinning and rope manufacture. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice.

COTTON 303 COTTON SPINNING (2-2)3
Prerequisite: COTTON 204 PROF. GOODWIN
Required in Course VI-G

This subject is similar to COTTON 301, but the time devoted to laboratory practice is shortened.

COTTON 304 COTTON WINDING AND TWISTING (2-2)3
Prerequisite: COTTON 303 PROF. GOODWIN
Required in Course VI-G

This subject is similar to COTTON 302, but the time devoted to laboratory practice is very much shortened.

COTTON 311 STAPLE FIBER MANUFACTURE (1-1)1½
Prerequisite: COTTON 301 *taken concurrently* PROF. MERRILL
Required in Course I

Using the preparatory subjects as a background, this subject offers a study of the methods of manufacture of various staple fibers, such as wool, rayon, or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the subject is planned to take advantage of the new developments as they appear. A considerable amount of the work in this subject is of the discussion type, which aims to correlate all the work on yarn manufacture and to bring it to bear on the processing of staple fibers.

Cotton 322 COTTON QUALITY CONTROL (1-0)1
Prerequisite: Cotton 301 Prof. Merrill
Required in Course I

While it is customary to point out defects in the materials during the processing in all the lecture and laboratory work, this subject provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this subject. Every effort is made to develop the diagnostic ability of the student so that he may readily recognize and remedy defects as he meets them.

Cotton 331 or 332 COTTON YARN MANUFACTURE SURVEY (3-1)3
Not open to students in Course I or VI-G Mr. Kent

For students with but a secondary interest in Cotton Manufacture, this survey outlines the processes used and the principles of cotton yarn manufacture. The work considers cotton qualities and production, the processes of opening, picking, carding, combing, drawing, roving, spinning, winding and twisting.

While this subject consists primarily of lectures, it is planned to include some laboratory demonstrations. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

Cotton 401 MILL ORGANIZATION (4-0)4
Prerequisite: Cotton 302 *or* 304 Prof. Merrill
Required in Courses I and VI-G

This subject correlates all of the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and for the handling of staple fibers are carefully covered. Estimates are made of the machinery necessary to keep plants in balance with some consideration of the best arrangements for economical handling.

Cotton 402 MANAGEMENT PROBLEMS (2-0)2
Prerequisite: Cotton 401 Prof. Merrill
Required in Course I

This subject supplements the one in Mill Organization with some added detail regarding the work in Mill Organization. In addition, this subject includes work on equipment arrangement for practical routing and operation, auxiliary equipment necessary for manufacturing efficiency. job descriptions and job assignments.

DESIGN

Des. 101 or 102 ELEMENTARY TEXTILE DESIGN (2-1)2
Prof. Golec

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and the derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves.

DES. 103 or 104 YARN CALCULATION (1-0)1
PROF. GOLEC

This subject includes relations and determinations of yarn numbers of cotton, woolen, worsted, linen, silk, and synthetics; grading of yarns, folded, ply, novelty and fancy yarns.

DES. 112 HANDLOOM WEAVING (0-3)1
PROF. GOLEC

This work consists of making original patterns and cloth construction. This subject correlates with the textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns in order to produce fabrics for different purposes.

DES. 122 PERSPECTIVE (0-2)1
PROF. ROSATTO

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing.

DES. 132 FREEHAND DRAWING (0-2)1
PROF. ROSATTO

This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop skill in depicting desired effects. It includes quick sketching and finished drawings of objects and of nature to build a drawing vocabulary which will be an aid to decorative expression.

DES. 203-204 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2)(2-2)6
Prerequisites: DES. 102 *and* 104 PROF. FOX
Open only to students in Course III

In the first semester, consideration is given to cotton fabrics using plain, twill, or sateen constructions, and employing stripe, check, or plaid patterns. In the second semester, fabrics studied are those having extra warp and extra filling figured patterns, together with Bedford cords, velveteens, plushes and corduroy fabrics. In both semesters, the work includes the analysis of the fabrics as well as the necessary calculations required to reproduce them or to construct fabrics of similar character.

DES. 211-212 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2)(2-2)6
Prerequisites: DES. 102 *and* 104 MR. GRAY
Open only to students in Course III

In the first semester, instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second semester, instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures.

DES. 222-223 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1)(2-1)4
Prerequisites: DES. 101 *and* 103 PROF. FOX
Required in Courses I, V and VII
Not open to students in Course III

This subject offers work similar but less detailed than the material covered in DESIGN 203-204 and DESIGN 301-302.

DES. 224 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2
Prerequisites: DES. 101 *and* 103 PROF. FOX
Required in Courses VI-E and VI-G
Not open to students in Course III

This is a skeleton course patterned after DES. 222-223.

DES. 232-233 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1)(2-1)4
Prerequisites: DES. 101 *and* 103 MR. GRAY
Required in Courses II and VII
Not open to students in Course III

This subject offers work similar to but less detailed than the material covered in DESIGN 211-212 and DESIGN 311-312.

DES. 234 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2
Prerequisites: DES. 101 *and* 103 MR. GRAY
Required in Courses VI-E and VI-G
Not open to students in Course III

This is a skeleton subject patterned after DESIGN 232-233.

DES. 242 DECORATIVE DESIGN (0-2)1
Suggested preliminaries: DES. 122 *and* 132 PROF. ROSATTO
Open only to students in Course III

Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed patterns. Historic designs of different periods and peoples are covered to supply the student with a background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present-day decorative textiles.

DES. 251-252 COLOR (1-1)(1-1)4
Open to students in Courses III and VII PROF. ROSATTO

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids, and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice for the fabric in question.

Due to the work required as a part of the laboratory, extra credit is allowed.

DES. 262 COLOR (1-1)1
Required in Course I PROF. ROSATTO

This subject includes the same general information as DES. 251-252 but in less detail.

DES. 272 COLOR (1-1)1
Required in Course II PROF. ROSATTO

This subject includes the same general information as DES. 262 but deals with blends of colored stock.

DES. 301-302 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2)(2-2)6
Prerequisite: DES. 204 PROF. FOX
Open only to students in Course III

In the first semester, synthetic fabrics are analyzed covering design, construction, yarns, both spun and filament, and finished fabric characteristics. Also covered in this semester are cotton ply fabrics and include the weave and construction of two-three, and four-ply fabrics together with the analysis of these fabrics in wide woven and narrow woven non-elastic belts and webs. The second semester covers wide and narrow woven elastic webs, piques, and lappet and swivel woven fabrics, as well as Mitchelins, loose and fast-back quilting fabrics and toilet cloths.

DES. 303 SYNTHETIC FABRIC DESIGN AND ANALYSIS (1-2)2
Prerequisite: DES. 222 *or* 224 PROF. FOX
Required in Course V

This subject covers the comparison and analysis of various synthetic fabrics as to the construction, yarn denier, filament size, and weave, as well as finished fabric characteristics.

DES. 311-312 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2)(2-2)6
Prerequisite: DES. 212 MR. GRAY
Open only to students in Course III

This includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs as well as the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, size of yarn and value. Particular attention is given to the construction of new designs by the use of suggestion sheets as well as to the new fabrics to be constructed upon a base fabric, previously analyzed, in the manner outlined on the suggestion sheets and keeping within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. This subject is restricted to woolen and worsted fabrics, but includes blends with other fibers, as well as filament yarn combinations for fancy effects.

DES. 401 LENO FABRIC DESIGN AND ANALYSIS (1-1)1½
Prerequisite: DES. 302 *or permission of instructor* PROF. FOX
Open only to students in Course III

A complete study is given in leno fabric design, using the modern steel doups and super-doups.

DES. 402 ADVANCED TEXTILE DESIGN AND ANALYSIS (1-2)2
Prerequisites: DES. 312, DES. 401, WEAV. 302 *or permission of instructor* PROF. GOLEC
Open only to students in Course III

The first half of the semester is devoted to the study of Leavers Lace including history, manufacture, finishing, a detailed study of the Leavers machine, and the basic principles of lace design and drafting. The second half of the semester covers a study of embroideries and rugs. Schiffli embroidery includes the Schiffli machine, basic principles of Schiffli design,

manufacturing, finishing and types and end uses of embroidery. Rugs include a study of the principles of construction of the analyses of Chenille, Wilton, Brussel, Tapestry, Velvet, and Axminster carpets.

DES. 411-412 JACQUARD DESIGN AND WEAVING (1-2)(1-2)4
Prerequisites: DES. 204, DES. 242, WEAV. 302 — PROFS. GOLEC AND HOELLRICH
Required in Course III

This subject correlates the instruction in weaving on the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, to choose the proper weave for both the background and foreground, to cut cards and lace, and to weave the fabric.

DES. 413 or 414 JACQUARD DESIGN (0-2)1
Prerequisite: DES. 101 *or* 102 — PROF. GOLEC

This is an elective subject in which the student is taught to transfer a given motif to cross section paper, to choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to enable the student to appreciate the complete operation from the motif to the loom.

DES. 421 or 422 DESIGN AND WEAVING SEMINAR — STAFF
Credits and hours to be arranged
Prerequisite: Major in Course III or by special permission

This subject consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

ECO. 201-202 ECONOMICS (3-0(3-0)6
Required in Courses I, II, III, IV, V, VI-E, VI-G and VII — PROF. CUSHING

A basic subject in the principles and practices of economics. This subject will also deal briefly with economic history, showing how the present economic system has evolved from past systems. It will show how the experience of the past can aid in the solution of present problems.

ECO. 311 ECONOMIC STATISTICS (3-0)3
Required in Course VII — PROF. EDLUND

This subject covers the basic concepts of the statistical method with special emphasis on those approaches of most interest to the student of management. Topics covered include: measures of central tendency, graphic methods, dispersion, skewness, sampling, normal curve, index numbers, correlation, time series, secular trend, seasonal variation, business cycle and statistical forecasting.

ECO. 321-322 PRINCIPLES OF MARKETING (3-0)(3-0)6
Required in Course VII — PROF. EDLUND, MR. MANDELL

ECO. 321 is an introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. This subject will cover the history and

economic importance and the functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries. It will also consider the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Eco. 322 is a continuation of Eco. 321. Some of the topics studied are: economic aspects of fashion, branding, sales promotion and advertising, market research, analysis of distribution costs, forecasting, market potentials, price policies, legal aspects of marketing, vertical integration, sales planning and control and the complete campaign.

Eco. 341-342 PRINCIPLES OF ACCOUNTING (3-0)(3-0)6
Required in Course VII MR. MANDELL

This subject is a survey of accounting principles with emphasis upon the nature, interpretation, and utilization of accounting data. The introductory material will include a consideration of the economic significance of accounting, the underlying accounting concepts, the theory of debits and credits, and the organization and use of accounting records. Attention will then be given to the preparation and interpretation of reports and statements of financial position, such as the balance sheet and the statement of profit and loss. Finally, the subject material will be projected to include a study of basic credit considerations such as determination of risk, analysis of mercantile reports and the studying of creditor-debtor relationship.

Eco. 342 is planned to give a knowledge of modern methods of cost accounting with emphasis upon their application to textile manufacturing processes. It includes discussion of methods of handling and accounting for raw materials, direct labor, overhead and its distribution, normal costs and their pre-determination, budgeting, cost reports and their use for control purposes.

Eco. 343 ACCOUNTING AND COSTING (3-0)3
Required in Courses II, III, VI-E, VI-G and IX MR. MANDELL

A condensation of Eco. 341-342 with about one half the subject devoted to a study of the underlying principles of accounting records and about one half devoted to the methods of textile cost accounting and systems employed.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING (4-0)4
Required in Course VII PROF. EDLUND

A comprehensive subject dealing with the fundamental principles of advertising and salesmanship. Topics covered include: psychology of selling and advertising, copy writing, layout, printing and engraving, testing and research, planning an advertising campaign, government restrictions, types of media, radio advertising, trademarks, building a selling talk, fundamentals of salesmanship, types of personal selling, personality, retail salesmanship, training, etc.

Eco. 351 TEXTILE MARKETING (2-0)2
Required in Courses I, II, III, IV, V and VI-G PROF. EDLUND

This subject is a condensation of the more important parts of Eco. 321 and 322, of particular interest to those not specializing in distribution. It will survey the marketing channels for textiles, chief intermediaries, fashion, branding, marketing research, vertical integration and sales promotion.

Eco. 412 INDUSTRIAL MANAGEMENT: PRINCIPLES AND PROBLEMS (4-0)4
Required in Courses I, II, III, V, VI-E, VI-G, VII and IX PROF. ROBERTSON, MR. MANDELL

This subject is divided into four general areas: Backgrounds of Modern Industry; Organization of the Industrial Enterprise; The Operation of the Modern Industry; and Coordination of the Productive Processes. The text material is supplemented with current readings and case material.

Among the topics covered are: Risks, Forecasting, Financing, Product Development, Plant Layout, Production Controls, Personnel Management, Time and Motion Studies, Job Evaluation, and Wage and Salary Administration.

Eco. 421 FOREIGN TRADE (3-0)3
Prerequisite: Eco. 202 MR. MANDELL
Required in Course VII

This subject will study the growth and development of foreign trade, international commercial policies, transportation and communication facilities, and international finance. A good portion of the term's work will be devoted to a study of the practical aspects of exporting and importing. Examples will be given in the textile field wherever possible and actual documents relating to foreign trade will be exhibited and used in regular class work.

Eco. 431-432 SELLING POLICIES (3-0) (3-0)6
Prerequisite: Eco. 322 PROF. EDLUND
Required in Course VII

This subject will cover the development of administrative policy and guiding principles in the marketing, pricing, styling and merchandising of textile products. Topics covered include: sales supervision and control, credit policies, inventory control, standardization and simplification, the sales contract, arbitration, trade associations, principles of wholesaling and retailing, use of cost accounting in distribution.

The second term is conducted by the seminar method and includes discussions and reports on business cases involving all phases of management and distribution policy.

Eco. 468 CORPORATE FINANCE (3-0)3
Prerequisite: Eco. 342 *or* 343 MR. MANDELL
Required in Course IX

This subject will study the instruments of corporate finance, the financing of business enterprises, the legal nature of the corporation, technical features of stocks and bonds, principles of capitalization, working capital management, surplus and dividend policies, business combinations and business reorganizations.

ENGINEERING

ENG. 102 MECHANISM (4-0)4
Required in Courses I, II, V, VI-E, VI-G and VII PROF. THOMAS, MR. KENNEDY

The principles studied are of general application, textile machinery in particular furnishing an unusually large variety of specific examples. Frequent reference is made to these examples in the development of the subject. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, epicyclic gear trains and intermittent motion devices.

ENG. 104 MECHANISM (2-0)2
Required in Courses III, IV, VIII and IX PROF. THOMAS
Not open to students in Courses VI-E and VI-G

This subject is an abbreviation of ENG. 102 and is designed for those students not majoring in engineering.

ENG. 111 ENGINEERING DRAWING (0-6)2
Required in all courses PROF. GELINAS AND STAFF

This subject consists of both freehand and mechanical drawing and covers the following items: lettering, geometric construction, orthographic projection, isometric and cabinet drawing, and dimensions.

ENG. 112 ENGINEERING DRAWING (0-6)2
Required in Courses I, II, V, VI-E, VI-G, VII, VIII and IX PROF. GELINAS AND STAFF

A continuation of ENG 111 which includes the following topics: auxiliary views, cross sections, advanced dimensioning, sketching of machine parts, working drawings, tracing and blueprinting, intersections and developments.

ENG. 122 MACHINE TOOL LABORATORY (1-2)1
Required in Courses I, II, V, VI-E, VI-G, VII and VIII MESSRS. BELL, AINSWORTH AND STAFF

The objective of this subject is to give the student an insight into the processing of metals through lectures and practical laboratory applications covering the basic machine tools such as the lathe, shaper, drill-press, and milling machine, and also the uses of measuring instruments, threads, and gears. Lectures and demonstrations cover topics such as pattern work, foundry practice, die-casting, welding and forging.

ENG. 201 MACHINE DRAWING (0-3)1
Prerequisite: ENG. 112 PROF. GELINAS
Required in Courses VI-E and IX

This subject is made up of several short problems involving centers of gravity, counterweights, cam layouts, piping, welding, sheetmetal drafting and assembly drawings.

ENG. 212 HEAT AND POWER (2-2)3
Prerequisite: PHYS. 201 MR. LAREAU
Required in Course II
Not open to students in Course VI-E or VI-G

This subject is similar to ENG. 311 but is briefer and is designed for those not majoring in engineering.

ENG. 221 TEXTILE MECHANISM (1-2)1½
Prerequisites: ENG. 102 *and* ENG. 112 PROF. HINDLE
Required in Course VI-E

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

ENG. 222 APPLIED MECHANICS (3-0)3
Prerequisites: MATH. 201 *and* PHYS. 101 MR. KENNEDY
Required in Courses VI-E and IX

This subject covers the fundamentals of statics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of

inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

ENG. 233 MACHINE TOOL LABORATORY (0-3)1
Required in Course VI-E MESSRS. BELL AND AINSWORTH

This subject is a continuation of ENG. 122 giving practical and more detailed instruction in such operations as lay-outs, filing, drilling, planing and shaping, and places special emphasis on precision work.

ENG. 301-302 ADVANCED APPLIED MECHANICS (3-0)(3-0)6
Prerequisites: ENG. 222 *and* MATH. 202 PROF. HINDLE
Required in Course VI-E

This subject covers the general topic of strength of materials; including such topics as simple stresses, strain, bending moments, shearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, and stress analysis by strain gage methods.

ENG. 311 PRINCIPLES OF HEAT ENGINEERING (3-2)4
Prerequisites: ENG. 102, MATH. 202 PROF. WELLS
and PHYS. 202
Required in Course VI-G

The basic principles of thermodynamics, properties of steam and its utilization in manufacturing processes, and the combustion of fuels are considered in this subject.

A brief treatment of steam engines, turbines and pumps is also included. Special consideration is given to the use of steam in textile mills.

ENG. 312 HEAT ENGINEERING (3-2)4
Prerequisites: MATH. 202 *and* PHYS. 201 PROF. WELLS
Required in Course VI-E MR. LAREAU

The purpose of this subject is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures, and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS (3-0)3
Prerequisites: MATH. 201 *and* PHYS. 101 MR KENNEDY
Required in Courses VI-G and IX

A more elementary and condensed treatment of ENG. 301-302.

ENG. 331 MILL ENGINEERING (3-0)3
Prerequisite: ENG. 222 PROF. HINDLE
Required in Course VI-E

This subject consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints; calculation of allowable floor loads; stresses in beams and columns; machinery layout and the use of the transit in elementary surveying.

ENG. 332 ENGINEERING MATERIALS (2-0)2
Prerequisite: PHYS. 202 PROF. HINDLE

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treatment; also the properties and uses of non-metallic engineering materials such as timber, cement, concrete, rubber, plastics and mechanical fabrics.

ENG. 342 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4
Prerequisite: PHYS. 321 PROF. HORTON BROWN
Required in Courses VI-E and VIII

At the beginning of this subject polyphase circuits are considered. The greater part of the subject, however, is devoted to direct-current generators and motors with a study of their construction and characteristics. The accompanying laboratory work illustrates the various methods of measuring polyphase power, and of determining the characteristics of direct-current generators and motors. To be followed by ENG. 401.

ENG. 344 ELECTRICAL MACHINERY (3-2)4
Prerequisite: PHYS. 321 PROFS. HORTON BROWN
Required in Courses VI-G and IX AND OUELLETTE

This subject is a condensation of ENG. 342 *and* ENG. 401.

ENG. 351 EXPERIMENTAL APPLICATIONS OF STATISTICS (3-0)3
Prerequisite: MATH. 201 *or* 203 PROF. BALL
Required in Courses VI-E, VIII and IX

The first part of the subject deals with those fundamental statistical measures which are required for the analysis of experimental data. The second part deals with the practical applications of statistics to quality control and to the planning of industrial experiments.

ENG. 401 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4
Prerequisite: ENG. 342 PROF. HORTON BROWN
Required in Courses VI-E and VIII

This is the second semester of work in the electrical field having been preceded by ENG. 342 in the junior year.

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

ENG. 402 TEXTILE APPLICATIONS OF ELECTRICITY (1-4)1
Prerequisite: ENG. 344 or 401 PROF. HORTON BROWN
Required in Courses VI-E and VI-G

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. Trips are made to local mills to see the equipment in actual operation.

ENG. 411 ADVANCED HEAT ENGINEERING (2-2)3
Prerequisite: ENG. 312 PROF. WELLS
Required in Course VI-E MR. LAREAU

The topics developed are kinematics of reciprocating steam engines, steam turbines, pumps, condensers, and internal combustion engines. Special atten-

tion is given to the mechanical principles on which the steam engine operates, with detailed discussion of the valve gear and governing devices. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the subject, the historical development, classification and types of turbines and internal combustion engines are discussed.

ENG. 421 ENGINEERING DESIGN OF TEXTILE STRUCTURES (2-0)2
Prerequisites: ENG. 321, MATH. 202 and PHYS. 202 — PROF. BALL
Required in Course VI-E

This subject correlates the engineering properties of textile materials with engineering principles and textile processing to produce textile products with desired properties. The principles of structure of mechanical fabrics and those in the consumer goods classification are considered.

ENG. 422 TEXTILE PROCESS INSTRUMENTATION (2-0)2
Prerequisite: PHYS. 202 — PROF. THOMAS
Required in Courses VI-E and VI-G

This subject is divided into three parts. First, a study is made of the indicating and recording instruments used to measure such common textile process variables as pressure, temperature, humidity, liquid level, fluid flow, etc.

The second part covers an analysis of the mechanisms (pneumatic and electric) which are used to control these variables, and includes a detailed discussion of the final control elements, such as valves and motor levers, which are associated with the controller mechanisms.

Finally, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, and finishing are studied from data obtained from actual mill installations.

ENG. 424 MACHINE DESIGN (2-2)3
Prerequisites: ENG. 221, 233 and 302 — PROF. HINDLE
Required in Course IX

Dealing first with the design of fundamental machine elements, the work leads to the design of critical parts of some machines.

ENG. 431 ADVANCED PHYSICAL TESTING (1-3)2
Prerequisite: TEX. 312 — PROFS. BALL AND THOMAS, MR. KENNEDY

This subject provides a more detailed analysis of the textile testing methods currently utilized in the industry, both in quality control and in research, extending the laboratory work to cover a wider variety of equipment than is studied in TEX. 311-312.

ENG. 501 STATISTICAL QUALITY CONTROL (3-0)3
Prerequisite: ENG. 351 — MR. KENNEDY

This subject includes a study of the various types of control charts for maintaining quality of manufactured products and of the several types of sampling plans for the reduced inspection of manufactured products and of raw materials. Applications of the foregoing statistical techniques to industry in general are discussed, with special emphasis on their application to the textile and other industries.

ENGLISH AND HUMANITIES

ENGL. 101-102 ENGLISH COMPOSITION AND LITERATURE (3-0)(3-0)6
Required of all freshmen PROFS. DOW AND RILEY
MR. STEARNS

A basic subject in rhetoric and composition, relating specifically to the four forms of discourse, viz., description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

ENGL. 201 or 202 SPEECH (2-0)2
Required in all courses PROF. DOW

The aim of this subject is to achieve effective delivery of various types of speech. All kinds of delivery—extemporaneous, impromptu, memorized, etc., are studied and analyzed.

ENGL. 211 or 212 BUSINESS ENGLISH (1-0)1
Required in all courses PROF. DOW

Analysis and practice in letter writing, and a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity.

ENGL. 222 APPRECIATION OF LITERATURE (3-0)3
Prerequisite: ENGL. 102 PROF. DOW

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

FIN. 401-402 WOOLEN AND WORSTED FINISHING (2-3)(2-3)6
Prerequisite: CHEM. 102 PROF. NOWELL
Required in Course II

This subject is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbing, brushing, shearing and pressing.

FIN. 411 or 412 WOOLEN AND WORSTED FINISHING (3-3)4
Prerequisite: CHEM. 102 *or* 104 PROF. NOWELL
Not open to students in Course II

This subject is a similar but abbreviated version of FIN. 401-402, designed for students not majoring in wool manufacture.

FIN. 421-422 COTTON AND SYNTHETIC FINISHING (2-3)(2-3)6
Prerequisites: CHEM. 222 *and* TEX. 302 PROF. McDONALD
MR. PEIRENT
Required in Course I

All of the major physical and chemical operations necessary for the conversion into the finished state of staple gray fabrics made from cotton and/or synthetic fibers are covered. In addition to inspection, singeing, washing,

padding, drying, calendering, etc., the preliminary wet processing operations through dyeing are illustrated. Among the types of finishes employed are those for backfilling, softening, repelling, stabilizing, decating, etc., as well as the themoplastic and thermosetting resins.

FIN. 431 or 432 COTTON AND SYNTHETIC FINISHING (3-3)4
Prerequisite: TEX. 302 — PROF. MCDONALD
Not open to students in Course I — MR. PEIRENT

The subject is offered as the final step in the integration of cotton and synthetic fibers from the raw material to the consumer product. It consists of all major operations necessary in the transformation of the staple grey fabrics of the above content except the bleaching and dyeing which is given separately. These operations consist of shearing, singeing, washing, padding or mangling, miscellaneous drying, calendering, etc. Among the group of finishes are backfilling, softening, repelling, stabilizing, decating, etc. Also considered are the application of thermoplastic and thermosetting resins by padding and coating.

KNITTING

KNIT. 401 KNITTING (2-5)4
Prerequisites: DES. 102 *and* ENG. 102 — PROF. JONES

This subject is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

KNIT. 403 or 404 KNITTING (2-3)3
Prerequisites: DES. 102 *and* ENG. 102 — PROF. JONES

This subject is similar to KNIT. 401, but requires less laboratory time.

KNIT. 412 ADVANCED KNITTING (2-5)4
Prerequisite: KNIT. 401 — PROF. JONES

This is an advanced subject for students who are specializing in knitting. With the approval of the department head, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

GERMAN 201-202 TECHNICAL GERMAN (3-0) (3-0)6
Required in Course IX — PROF. CUSHING

An introductory subject in the basic elements of German, leading to a working knowledge of technical German. This subject is aimed primarily at developing a reading ability in scientific German.

GERMAN 301-302 ADVANCED TECHNICAL GERMAN (3-0) (3-0)6
Prerequisite: GERMAN 202 *or equivalent* — PROF. CUSHING

GERMAN 301 *may be taken without continuing* GERMAN 302

This subject is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

LEATHER

Lea. 101 SURVEY OF LEATHER (1-0)0
Required in Course IX Staff

A brief history of leather, its raw materials and its relation to man and industry.

Lea. 202 APPLIED LEATHER ANALYSIS (1-6)3
Prerequisite: Chem. 213 Prof. Chouinard
Required in Course IX

A subject designed to acquaint the student with the accepted Methods of Analysis of the American Leather Chemists Association and other supplementary procedures.

Lea. 301-302 LEATHER MANUFACTURE (3-6)(3-6)10
Required in Course IX Prof. Chouinard

This is the student's introduction to the general technology of leather manufacture. The first semester is devoted to the study of government regulations in imported hides and skins, studying the purchasing of hides and skins and classifying various hide damages. This is followed by work on the handling of raw stock at the tannery, unhairing, bating and hide classification. The second semester is concerned primarily with the study of vegetable tanning, chrome tanning and various other types of tanning. In the work throughout the year the material covered in lectures is supplemented by laboratory studies on a small scale.

Lea. 303 HISTO-PATHOLOGY OF ANIMAL TISSUES (1-6)3
Prerequisite: Chem. 202 Staff
Required in Course IX

The histological study of animal hide as regards cell reproduction, glands and thermostat mechanism growth of hide fibers, elastin, nerves and grain patterns.

Lea. 304 MICROSCOPY IN TANNING (1-3)2
Prerequisite: Lea. 303 Staff
Required in Course IX

This subject is designed to educate the student in the use of a microscope as an aid in the study of hides and leathers under various conditions. The technique of using normal, fluorescent and polarized light is taught as well as the application of staining with some emphasis on photomicrography.

Lea. 322 TANNING MECHANISMS (3-0)3
Prerequisite: Chem. 202 Prof. Chouinard
Required in Course IX

The general study of the various concepts applied to the understanding of what constitutes Tanning, both practical and theoretical. This will involve a study of the raw materials as well as the finished product.

Lea. 401-402 LEATHER MANUFACTURE (3-6)(3-6)10
Prerequisite: Lea. 302 Prof. Chouinard
Required in Course IX

A continuation of the study into the technology of leather manufacture covering the various currying treatments applied to rough leather such as fat liquoring, stuffing, dyeing and the various mechanical operations of setting, stretching, etc. It is intended to show how widely the physical properties of

leather may be varied and controlled by the proper application and selection of these numerous operations and treatments.

LEA. 404 PROPERTIES OF LEATHER (2-3)3
Prerequisites: ENG. 351 *and* LEA. 401 STAFF
Required in Course IX

A practical and theoretical study of the characteristics of leather in relation to the end use. Studies will be made on measuring and classifying the effect of changes in manufacturing procedure, both chemical and physical. Leather because it is a natural product varies considerably within the same hide. Thus, the nature of this variation is very important and the study of any changes effecting it are in turn important.

LEA. 411-412 LEATHER PROBLEMS (1-6)(1-6)6
Prerequisite: LEA. 302 PROF. CHOUINARD
Required in Course IX

This subject is designed primarily to enable the student to put into practical application the various scientific principles of physics, chemistry, mathematics, economics, etc. on problems of an industrial nature. This may encompass anything from the design and layout of any of a number of special leather plants to the suggested solution of practical problems which arise in the operation of a modern leather business.

MATHEMATICS

MATH. 101-102 COLLEGE MATHEMATICS (4-0)(4-0)8
Required of all freshmen PROF. HARRY BROWN AND STAFF

The work in the first term consists of algebra, plane trigonometry, and an introduction to analytic geometry. Algebra is reviewed through quadratics and then logarithms, simultaneous equations, and theory of equations are studied. In plane trigonometry, the solution of right and oblique triangles are reviewed and identities and equations are taken up. Instruction in the use of the slide rule is given and the use of approximate data is discussed. Between two and three weeks are devoted to equations of the straight line.

In the second term, the following topics are considered: equations of various curves, differentiation of algebraic functions, maximum and minimum values, rates and differentials.

MATH. 201-202 ANALYTIC GEOMETRY AND CALCULUS (3-0)(3-0)6
Prerequisite: MATH. 102 PROF. HARRY BROWN
Required in Courses VI-E, VI-G and IX AND STAFF

In the first term the following topics are treated: the circle, parabola, ellipse, hyperbola, indefinite integrals, summation of integration and applications of integration. In the second term the topics treated are: differentiation of transcendental functions, methods of integration, centers of gravity, moments of inertia, polar coordinates, empirical formulas.

MATH. 203-204 MATHEMATICS FOR CHEMISTS (4-0)(2-0)6
Prerequisite: MATH. 102 PROF. HINDLE
Required in Courses IV and VIII AND OUELLETTE
MR. SABBAGH

This subject is a continuation of MATH. 101-102. The first term consists of analytic geometry and calculus including the following topics: the conic

sections, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic and trigonometric functions.

The second term includes precision of measurements, use of numbers in calculation, semi-logarithmic and logarithmic graphs, polar coordinates, three component heterogeneous systems, empirical equations, methods of least squares, series, differential equations with chemical applications and partial derivatives.

MATH. 205 MATHEMATICS (4-0)4
Prerequisite: MATH. 102 — PROFS. HORTON BROWN
Required in Courses I, II, III, V and VII — AND OUELLETTE
MR. DEVEJIAN

In this subject, which follows MATH. 101-102, students not majoring in chemistry or engineering take up conic sections, integration of algebraic functions with applications to areas, construction of nomographic charts, and derivation of empirical equations.

MATH. 501 DIFFERENTIAL EQUATIONS (3-0)3
Prerequisite: MATH. 202 *or* 204 — PROF. OUELLETTE

The following topics are treated: a review of series and partial differentiation, first and second-order differential equations, and first and second-order partial differential equations. The practical applications illustrated are designed for the chemist and the engineer.

PAPER

PAPER 101 SURVEY OF PULP, PAPER, AND PAPER USES (1-0)0
Required in Course VIII — PROF. BROUGHTON

This subject treats briefly of the history of paper, present day production and uses so that the student can better understand the industry.

PAPER 201-202 PULP AND PAPER MANUFACTURE (3-0)(3-0)6
Prerequisite: CHEM. 102 — PROF. BROUGHTON
Required in Course VIII

Lectures on the production and technology of pulp and paper.

PAPER 302 PULP AND PAPER MANUFACTURE (3-0)3
Prerequisite: PAPER 202 — PROF. BROUGHTON
Required in Course VIII

This is a continuation of the earlier subject.

PAPER 303 WOOD TECHNOLOGY (3-3)4
Required in Course VIII — STAFF

This comprises an elementary study of the principal woods used in pulping, their occurrence and principal characteristics. This lecture work is accompanied by training in microscopy leading eventually to fiber analysis of a finished paper.

PAPER 312 PULP AND PAPER TESTING AND ANALYSIS (4-7)6
Prerequisites: CHEM. 213 *and* PAPER 202 — STAFF
Required in Course VIII

A series of lectures and laboratory periods designed to give a thorough knowledge of the testing methods and analyses carried out in the industry. Particular attention will be paid to the theory and principles of the test methods employed.

PAPER 401 PRACTICE WORK IN INDUSTRY 18 CREDITS
Prerequisite: PAPER 302 STAFF
Required in Course VIII

In order to give the student as thorough a knowledge of industrial problems and practices as possible, it is planned in cooperation with several mills and converting plants to set up practice stations. The students will spend several weeks at each of these stations working on technical problems of interest to the mill management but under the supervision of a member of the Institute staff.

PAPER 403 MATERIALS OF CONSTRUCTION, CORROSION 2 CREDITS
Prerequisite: PAPER 401 *taken concurrently* STAFF
Required in Course VIII

This subject, given at the Practice Stations, covers the common construction materials used in the industry and their ability to stand up under various conditions of use. It will be illustrated by examples in the plants studied.

PAPER 404 PAPER COATING AND CONVERTING (3-0)3
Prerequisite: PAPER 302 STAFF
Required in Course VIII

This subject covers the principal operations of the converting industry. Coating, treating and impregnating, laminating, embossing and creping will be treated and, if time permits, printing.

PAPER 412 INDUSTRIAL CELLULOSE CHEMISTRY (1-0)1
Prerequisite: CHEM. 202 PROF. BROUGHTON
Required in Course VIII

The manufacture and use of the chief cellulose derivatives will be reviewed. In addition, various chemical treatments for cellulose in the paper and textile fields will be discussed.

PAPER 414 ADVANCED PAPER PROBLEMS (2-6)4
Prerequisite: PAPER 401 STAFF
Required in Course VIII

This is designed to give the senior an opportunity to work upon a problem connected with some phase of the paper or paper converting industry. Problems will be selected by the student and staff in collaboration.

PHYSICAL EDUCATION (2-0)0

PROF. CUSHING
MESSRS. MOREY AND YARNALL

All members of the Freshman Class are required to take a course in physical training conducted under the direction of an instructor in physical education. It is planned to help each student meet reasonable standards of physical fitness and through regularity and continuity of physical exercise to maintain good physical condition. The men are taught basic skills in several team sports. Students on athletic squads are not required to attend these classes during the season they are actively engaged in that sport.

PHYSICS

PHYS. 101 PHYSICS (4-1)4½
Required of all freshmen PROF. THOMAS AND STAFF

The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile

or otherwise. Some of the topics treated in this subject are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its application, parallelogram and triangle of forces with applications, resolution and composition of forces, efficiency of simple machines, hydrostatics, elements of hydraulics, circular and harmonic motions.

PHYS. 201-202 PHYSICS (3-2)(3-2)8
Prerequisite: PHYS. 101
Required in all courses
PROF. HARRY BROWN
MESSRS. CHASE AND HALL

This is a continuation of PHYS. 101 and is a basic subject relating to the laws and principles of physics and their application. The topics taken up the first term are: wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are: reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics, and elements of nuclear physics.

PHYS. 321 ELECTRONICS VI-E (3-2)4
Others (3-1)3½
Prerequisite: PHYS. 202
Required in Courses VI-E, VI-G, VIII and IX
PROFS. HORTON BROWN AND OUELLETTE

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. It includes elements of vacuum and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation.

PHYS. 401 ADVANCED TEXTILE MICROSCOPY (1-3)2
Prerequisites: PHYS. 202 *and* TEX. 312
PROF. HARRY BROWN
MR. KENNEDY

This subject takes up the techniques of the microscopist, including the microscope using normal and polarized light, discussions of phase microscopy, staining, etc. Aspects of microtechnique and photomicrography applicable to textiles are emphasized.

PHYS. 402 ADVANCED TEXTILE PHYSICS (2-3)3
Prerequisites: MATH. 202, PHYS. 202, TEX. 312
PROF. HARRY BROWN

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The topics taken up include heat transmission of textile materials; color measurement; calculation of tristimulus values; transformation to dominant wave-length, colorimetric purity and brightness; measurement of refractive index of fibers; applications of phase microscopy; fluorescent microscopy; use of X-ray diffraction methods to determine crystal orientation and structure of fibers; spectrographic analysis; investigation of mineral elements in textile fibers; accurate methods of measuring stress, strain, viscosity, etc.

PHYS. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT
PROF. HARRY BROWN

Credits and hours to be arranged
Prerequisites: MATH. 202 *or* 204 *and* PHYS. 202

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectrophotometers.

SOCIAL SCIENCES

SOC. SCI. 212 WORLD HISTORY SINCE 1900 (3-0)3
PROF. CUSHING

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situation during the war years, 1914 to 1918, and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of the course content will concern the two-decade intermission, 1919-1939, with attention to such factors as the rise of new states, the origin and development of new concepts of nationalism, racism, and other phenomena, and the final alignment of world powers for World War II. The emphasis in the latter part of the subject will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

SOC. SCI. 221 ECONOMIC HISTORY; THE UNITED STATES (3-0)3
Required in Courses V and VIII PROF. ROBERTSON

This subject offers a study of the foreign and American backgrounds of the economic development of the United States since 1800. Special emphasis is placed upon the Industrial Revolution in America prior to the Civil War and upon the growing international economic importance of American manufacturing and trade during the period.

The major emphasis is upon the post-Civil War development of transportation, finance, manufacturing, and commerce and on the influence of these and other factors in the rise of corporate ownership and mass production and in the development of our present-day machine economy. Particular attention will be given to the economic influences of the two World Wars and to the post-war trends in general business conditions and their effects upon the national economy.

SOC. SCI. 222 MAN AND HIS ENVIRONMENT (3-0)3
Required in Course VII MR. STEARNS

This subject deals with man's morphological and physiological adaptations to his surroundings and with his struggle against the hostile forces in his environment. Emphasis is given particularly to the fields of ecology, genetics and eugenics.

Soc. Sci. 301 MODERN ECONOMIC PROBLEMS (3-0)3

Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and IX — Prof. Robertson

An intensive study of current developments in the American economy, with emphasis on such fields as security, welfare, labor unionism, labor economics, ownership and management of industry, and trends in government regulation. Lectures, seelcted readings and case material will be utilized.

Soc. Sci. 302 MODERN LABOR PROBLEMS (3-0)3

Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and VIII — Prof. Robertson

The subject will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the term the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of this study will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techniques of the bargaining table and the problems in drafting, interpreting and administering the modern labor contract.

Soc. Sci. 311 PSYCHOLOGY (3-0)3

Required in Course VII — Staff

This subject introduces the student to the place of psychology in the life of the individual and society and seeks to increase the student's understanding of man's mental and emotional processes. The subject matter deals with physiological bases of behavior and experience, attention, perception, memory, thinking, emotions, intelligence and personality in terms of the whole person in his social setting.

Soc. Sci. 312 SOCIOLOGY (3-0)3

Required in Course VII — Staff

This subject seeks to broaden the student's understanding of man's behavior as a unit of society. Topics studied include culture and related anthropological concepts, culture and society, groups, aggregations and institutions, social organization, social and cultural change, collective behavior, social drives, social psychology and the possibilities of human progress.

Soc. Sci. 401 or 402 INDUSTRIAL RELATIONS SEMINAR (2-0)2

Prerequisite: Permission of Instructor — Prof. Robertson

Required in Course V

This subject will give a small selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial relations. Case material and hypothetical problems in modern labor management will provide the basis for the study by the group.

Soc. Sci. 461 PERSONNEL MANAGEMENT (3-0)3

Prof. Robertson

This subject involves a comprehensive study of modern labor management techniques in the recruiting, selection, training, and placement of members of the work force. Major emphasis is placed upon the development and maintenance of personnel administration agencies and procedures within the framework of present-day American industry, with special attention to such matters

as employee health and safety, welfare and recreation programs, wage and salary administration, training and education, and management relations with labor organizations.

In addition to text material and selected readings, problems will be drawn from actual cases for study and solution by the students. Every effort will be made to acquaint the class with current personnel administration practices in industrial organizations of various types, and to give an appreciation of the importance and magnitude of the labor management function.

Soc. Sci. 463 BUSINESS LAW (3-0)3
Required in Course IX Prof. Robertson

This subject will cover the basic principles of commercial law. Topics studied include: contracts, agency, sales, partnerships, corporations, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guarantee, and bankruptcy.

Soc. Sci. 465 MANAGEMENT PROBLEMS SEMINAR (2-0)2
Prerequisite: Permission of Instructor Staff

A seminar for a group of selected students who will, under the guidance of the instructor, investigate one or more areas of special interest to the student in the field of finance, production or distribution. The results of the students' analysis and research will be presented in a formal report which will be permanently on file in the library.

SYNTHETIC TEXTILES

Syn. 102 ORIENTATION IN SYNTHETIC TEXTILES (1-0)1
Required in Course V Profs. Harris and Frederick

This orientation for freshmen who have elected to major in synthetic textiles has for its purpose the general integration, in the mind of the student, of the various subjects in his curriculum in terms of his educational objective. Since the student does not begin intensive study in synthetic textiles until his junior year, it is of vital importance that he be fully cognizant of the significance of the basic educational program of the first two years.

Syn. 301 FILAMENT YARN PROCESSING (2-0)2
Required in Course V Prof. Frederick

This subject deals with the processing of natural and man-made continuous filament fibers from the time they are made available to the textile industry by the manufacturer until they are ready for processing into fabric forms. The nomenclature, purposes, means of accomplishment, and results obtained in the various operations of soaking, winding, throwing, twist setting, coning, and single end sizing are covered in the lectures.

Syn. 302 THROWING PLANT ORGANIZATION (2-0)2
Prerequisite: Syn. 301 Prof. Frederick
Required in Course V

This subject is essentially a continuation of Syn. 301, with the emphasis being placed upon actual plant organization, processing procedures, and quality control. Plant layouts from machinery viewpoints are discussed and assigned for study. Field trips to local plants are an integrated part of the class work.

Syn. 311 MANUFACTURE OF SYNTHETIC FIBERS (3-0)3
Prerequisite: Chem. 202 Prof. Harris
Required in Course V

This subject covers the manufacture of man-made fibers. The rayon, estron, polyamide, polyester, vinyl, protein, mineral and metallic fibers are considered from the standpoint of their manufacturing and economic aspects. The subject is approached with the view of presenting the types of processes and the chemistry (reactions and structures) involved in the manipulation of natural high polymers and the synthesis and manipulation of synthetic high polymers into useful textile fibers.

Syn. 312 STRUCTURE AND PROPERTIES OF SYNTHETIC FIBERS (3-0)3
Prerequisites: Chem. 202 *and* Phys. 202 Prof. Harris
Required in Course V

In this subject, a study is made of the fundamental structure and properties of the manufactured fibers. The material is developed with the aim to relate the structures of the fibers to their properties and to lay the foundation for the more advanced work covered in Syn. 411-412.

Syn. 322 FILAMENT YARN PROCESSING SURVEY (2-0)1½
Prerequisite: Tex. 102 Prof. Frederick
Not open to students in Course V

A survey of the methods of handling natural and synthetic fibers in filament form designed to give the student a broad picture of the differences and their significances between staple and filament yarn production. Some of the lecture time is devoted to laboratory demonstration, and outside assignments may be made involving special study of the laboratory equipment.

Syn. 331-332 FILAMENT YARN LABORATORY (0-3)(0-3)2
Prerequisite or Concurrent Subject: Syn. 301
Required in Course V Prof. Frederick

This subject covers the laboratory aspects of Syn. 301, and consists of planned experiments and demonstrations involving the use of throwing machinery and processes by the student. Experiments include various yarn soaking studies, winding, twisting, coning and single end sizing operations, and quality control and power studies.

Syn. 411-412 PROPERTIES AND APPLICATIONS OF SYNTHETIC FIBERS (3-0)(3-0)6
Prerequisite: Syn. 312 Prof. Harris
Required in Course V

This subject is a continuation of Syn. 312. Much of the time will be spent on considerations of the fundamental properties of man-made fibers in relation to each other and to the behaviors of the finished textile resulting from these basic properties and the geometry imposed upon the fibers in the textile. To make the material more useful, comparisons are made with natural fibers and their textiles. Recent advances in the manufacture and study of fibers will be discussed whenever necessary to keep the subject matter included in Syn. 311 and Syn. 312 up to date.

Syn. 452 SYNTHETIC TEXTILES SEMINAR (2-0)2
Prerequisites: Syn. 302 *and* 411 Profs. Harris and Frederick
Required in Course V

A general discussion of the problems encountered in the synthetic textile field, including economics, manufacture, processing, properties and various

aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar develops an objective viewpoint of the subject by the student.

TEXTILES — GENERAL

Tex. 101 SURVEY OF TEXTILES (2-0)1
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII — Prof. Edlund

This subject is designed to give the student a broad general knowledge of the textile industry to enable him to choose a course more intelligently and to orient him in the relations between the various parts of the industry and the social and economic patterns in which they exist. Regardless of his field of specialization, it gives him an elementary knowledge of the entire textile field that should make his subsequent work more purposeful.

Tex. 102 INTRODUCTION TO FIBERS (2-0)2
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII — Prof. Harris

A general survey of the fibers used in the textile industry, including natural cellulosic (soft and hard), protein, and mineral fibers and the man-made fibers. The sources (location and distribution), production methods and statistics, the economics, and the preparation of the fiber for textile uses will be discussed. An introduction to the elementary properties of fibers making them suitable for specific textiles will also be presented.

Tex. 241 LIBRARY (1-0)1
Required in Courses I, II, III, V, VI-E, VI-G, and VII — Mr. Katz

This is a subject which introduces the student to the effective use of a library and familiarizes him with the past and current sources of information on textile topics.

Tex. 302 FABRICS (2-0)2
Prequisites: Des. 101 *and* 103 *or* Des. 102 *and* 104 — Prof. Golec
Design Major Prerequisites: Des. 204 *and* 212
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

This subject is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial uses. An analytical discussion is used so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc. used.

Tex. 311-312 TEXTILE TESTING (2-2)(2-2)6
Prerequisites: Chem. 102, Math. 102 *and* Phys. 202 — Prof. Frederick
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

This subject is designed to provide a foundation for more advanced work in testing, and is of sufficient breadth to benefit those students whose main need is an understanding and appreciation of the scope of testing and evaluation in the textile industry. The subject matter covers an applied approach to the statistical treatment of experimental data, and the basic mechanical

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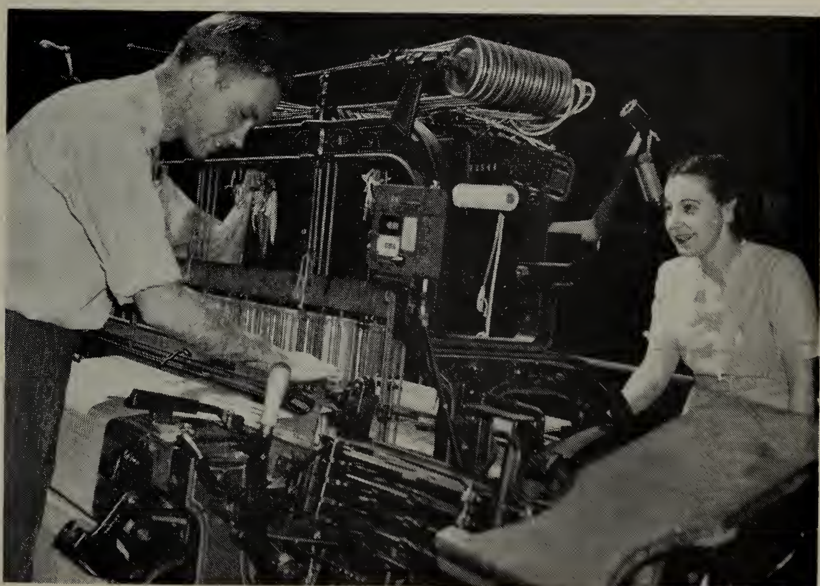


Weaving

or physical, chemical, and optical tools and techniques available to the industry for product control, development and evaluation. Primary emphasis is placed upon an understanding of the principles involved and an integration of the various phases of textile testing into a unified whole.

TEX. 501 or 502 METHODS OF RESEARCH (2-0)2
Prerequisite: Graduate Students only PROFS. BALL AND HARRY C. BROWN

A seminar to familiarize the student with the philosophy and methods of research, current problems in textile research and of the further use of textile literature.

TEX. 590-591 THESIS RESEARCH
Credits and hours to be arranged.

WEAVING

WEAV. 201-202 WEAVING (2-4)(2-4)7
Required in Course III MESSRS. ARMSTRONG AND HUNTER

The first semester's work deals with the study of the cam loom, its principal and auxiliary motions, a comparison with other types of looms, and a study of weaving terms and cloth defects in the weaving process. Narrow fabric weaving is incorporated in the laboratory exercises. The second semester's work covers all methods of warp preparation of all yarns with emphasis upon the conditions favorable to each system or combinations of systems.

WEAV. 211-212 WEAVING FOR MANUFACTURERS (2-2)(2-2)5
Required in Courses I, II and V MESSRS. ARMSTRONG AND HUNTER

This subject is similar to WEAV. 201-202, but utilizes less laboratory time.

WEAV. 221-222 WEAVING FOR ENGINEERS (2-0)(2-0)4
Required in Courses VI-E and VI-G MESSRS. ARMSTRONG AND HUNTER

This subject, designed for non-manufacturing majors, includes lecture material similar to that in WEAV. 201-202, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 301-302 WEAVING (2-4)(2-4)7
Prerequisite: WEAV. 201 PROFS. HOELLRICH
Required in Course III AND MERRILL

This subject covers dobby weaving and includes single and double index, single and double cylinder, chains, timing and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics and silk. This subject also covers pile cloth weaking, carpet weaving and leno weaving.

WEAV. 311-312 WEAVING FOR MANUFACTURERS (2-2)(2-2)5
Prerequisite: WEAV. 201 *or* 211 PROFS. HOELLRICH
Required in Courses I, II and V AND MERRILL

This subject is similar to WEAV. 301-302, but utilizes less laboratory time.

WEAV. 321-322 WEAVING FOR ENGINEERS (2-0)(2-0)4
Prerequisite: WEAV. 201 *or* 211 *or* 221 PROFS. HOELLRICH
Required in Course VI-G AND MERRILL

This subject, designed for non-manufacturing majors, includes the same lecture material as WEAV. 301-302, but includes no laboratory work other than lecture-demonstration and assignments.

WEAV. 333-334 WEAVING FOR ENGINEERS (1-2)(1-2)3
Prerequisites: DES. 223, 233 *or* DES. 224, 234 PROF. MERRILL
Required in Courses VI-E and VII AND MR. HUNTER

This subject covers warp preparation and weaving with emphasis on basic principles and eliminating details. The different systems of warp preparation are described and compared. Each type of loom is described and the capabilities and limitations of each are discussed. Considerable time is devoted to fabric defects, their cause and correction.

WOOL

WOOL 211-212 TOP MAKING (2-6)(2-6)10
Prerequisites: ENG. 102 *and* 112 PROF. KENNEDY
Required for Course II

This subject covers a study of the preparation of wool and allied hair fibers for processing on all systems of manufacture. Special emphasis is placed on wool buying, grading, sorting, scouring and drying, carbonizing, burr picking, worsted carding, backwashing, gilling, Warner Swasey Pin Drafter, Noble combing, tow to top conversion of synthetic fibers, Pacific Converter, top testing, and a study of classification of commercial tops.

Credit for laboratory has been increased to compensate for the preparation of reports required as a part of this work.

WOOL 215-216 TOP MAKING (2-2)(2-2)6
Prerequisites: ENG. 102 *and* 112 PROF. KENNEDY
Required in Course VI-G
Not open to students in Course II

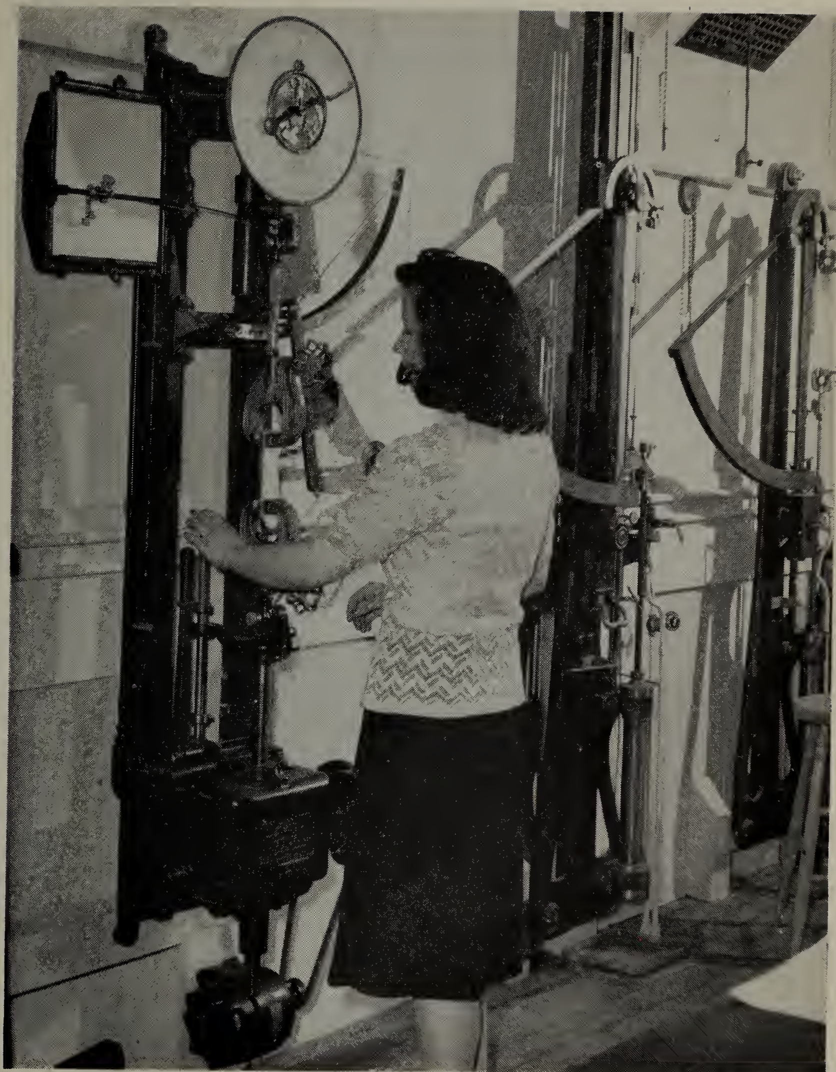
This subject covers the same lecture material as WOOL 211-212, but the laboratory time is considerably reduced.

WOOL 301-302 WOOLEN YARNS (2-4)(2-4)7
Prerequisite: WOOL 212 *or* 216 PROF. PERO
Required for Course II

This subject covers woolen system fiber blending, oiling, picking, carding, spinning, twisting and the handling of reused and reprocessed fiber. The processing of wool, manufactured and synthetic fiber, is studied in theory and practice. Special emphasis is given to details of woolen machinery such as tape and ring doffer type condensers, broadband and Apperly intermediate feeds, automatic weighing feeders, peralta rolls, card drives, and modern mule and ring spinning. The lecture study is augmented with many laboratory experiments and problems which are performed by the student.

WOOL 311 or 312 SURVEY OF WOOL MANUFACTURE (3-1)3
Prerequisite: TEX. 102 *suggested but not obligatory*
Required in Courses I, III, IV, V, VI-E and VII
PROF KENNEDY
Not open to students in Course II or VI-G

This subject is designed for those who are not majoring in wool manufacture and presents a comprehensive survey of the woolen and worsted yarn, and



Scott Yarn and Cloth Tester

felt manufacturing processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

Wool 321-322 WORSTED YARNS (3-3)(3-5)9
Prerequisite: Wool 212 *or* 216 Prof. Burtt
Required in Course II

This subject consists of both lectures and laboratory work. It supplements the subject matter given in Course 211-212, Top Making. Lectures cover advanced gilling; French combing; top analysis and stapling; worsted yarn manufacture, including drawing, spinning, and twisting for both the English and French systems; colored blending of dyed wool tops, also blending wool top with other fibers. The laboratory work covers each phase of the lecture work. Experiments run concurrently with the lectures. Gilling theories are demonstrated; French combing wool is processed into top on the French comb and both French and English system yarns are manufactured. Fundamentals are stressed in both lectures and laboratory.

Wool 323-324 WOOLEN YARNS (2-2(2-2)5
Prerequisite: Wool 212 *or* 216 Prof. Pero
Required in Course VI-G
Not open to students in Course II

This subject covers the same lecture material as Wool 301-302 but the laboratory time is reduced.

Wool 325-326 WORSTED YARNS (3-2)(3-2)7
Prerequisite: Wool 216 Prof. Burtt
Required in Course VI-G
Not open to students in Course II

This subject covers the same lecture material as Wool 321-322 but the laboratory time is considerably reduced.

Wool 412 WOOLEN AND WORSTED MILL ORGANIZATION (4-0)4
Prerequisites: Wool 302 *and* 322 Staff
Required in Course II

This subject covers a recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system of manufacture.

It also summarizes previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades to cover balanced mill equipment necessary to produce worsted cloth from wool top on both English and French systems of manufacture.

GRADUATES OF 1949

Master of Science in Textile Chemistry

Leo Shih-yen Chang
B.S., St. John's University, 1944

*Reinhard George Hochschild
B.T.C., Lowell Textile Institute, 1943

*Ernest Peter James
B.T.C., Lowell Textile Institute, 1942

*Joseph Bernard Masaschi
B.T.C., Lowell Textile Institute, 1944

*Chung-Sheng Na
B.S., Lowell Textile Institute, 1948

Uttamlal Vaghji Solanki
B.S., Royal Institute of Science, 1938

Master of Science in Textile Engineering

James Joseph Conlin, Jr.
B.S., U. S. Naval Academy, 1944

Bernard Giffler
B.A., Brooklyn College, 1943

John Calvin McWhorter, Jr.
B.S., United States Military Academy, 1946

Dharampal Amarnath Nanda
B.Sc., Bombay University, 1942

Tse Bie Quo
B.S., Chiao Tung University, 1939

Robert Lee Scott
B.S., University of Texas, 1941

Bachelor of Science in Textile Chemistry

*Walter Edgar Bill
Robert Daniel Brassil
*Milton Charatz
*Edward Cherowbrier, Jr.
Parker Willard Downing
Maurice Fishman
*William Matthew Foley
*Lawrence Carroll Gardner
*Phillip Arthur Gruber
Clifford Arthur Harvey
*George Demeritt Kenniston
*Herbert Michael Lachut
Charles H. Lapidus
Laurence Francis McMahon
Alvin Emery Mitchell
*Robert John Peirent
William Fabian Piekarski
Max Rhodes
Raymond Emile Roy
William Martin Segall
John Andrew Shaughnessy
*Charles Russell Sheehan
John Francis Stroup, Jr.
*James William Sweeney
*Charles Richard Trommer
Earl Raymond Wilbur

Bachelor of Science in Textile Manufacturing

Leon Bess
Sam Groveham Illingworth

Bachelor of Science in Textile Engineering

Manuel Affler
John Alden
George Aslanoglou
*Harvey Bernard Blackman
*Russell Lee Brown, Jr.
Alexander H. Colman
James Edward Davis
Louis Paul DeAngelis
Stephen Potter DeMallie
Joseph Gordon Duffy
Joseph Thomas Dulack, Jr.
Mehmed Can Eliyesil
Arthur Murray Feltheimer
Marvin Joseph Field
Richard Coleman Fox
Richard Warren Fraser
Robert Friedlander
Gerald Gary Fruchtman
Frank Antonio Giglio
Dexter Stuart Gilchrest
*Seymour Gottlieb
Phillip Leon Greene
*Julian Barnes Gregg
Leopoldo L. Guggenheim
*Richard Libby Hallett
William Lafayette Handy
*Simon A. Haskel
*Thomas Augustus Huff
James Francis Kane
Christos Nikitas Kavouras
John Michael King, Jr.
Marina Kosartes
Ernest Krivis
Seymour Leon Lash
*Roy Gordon Lent
Stanley Baker Lesser
Jordan Levin
Manfred Liverant
*Victor James Luz
John Peter McCartin
John Paul Maguire
Sidney Natter
*Frederick Walter Nystrom
Americo Seabra Moura Pinto
Eugene Harvey Polebaum
Ingo Arlindo Renaux
Warren Paul Riordan, Jr.
Manuel August Rosa
Thomas Martin Sayers
*Walter Schwarz
Sumner Shapiro
Edward Isaac Stillman
Philip Willson Sugg
John Edward Sullivan
Paul Vomvouras
Manuel Weinstein
*John Benno Weiser
Paul Henry Woodward
William Arthur Young

---

* Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF STUDENTS

GRADUATE STUDENTS

Holders of Fellowships are indicated by the asterisk (*).

Home Address	*College Address*
ALPERT, EUGENE OLIVER, VI, Brooklyn, N. Y. B.A., Duke University, 1946	272 Merrimack Street
BAREFIELD, WILLIAM CARTER, Major, USA, VI Americus, Ga. B.S., Alabama Polytechnic Institute, 1931	Tewksbury
*CHARATZ, MILTON, IV, Brooklyn, N. Y. B.S., Lowell Textile Institute, 1949	42 South Walker Street
CHEN, CHUNG CHENG, IV, Shanghai, China B.S., St. John's University, 1946	222 Textile Avenue
CHEROWBRIER, EDWARD, JR., IV, Methuen, Mass B.S., Lowell Textile Institute, 1949	
CROSBY, PHILIP, LTJG, SC, USN, VI, Sherman, Texas B.S., United States Naval Academy, 1944	24 Hawthorne Street
*FINNIE, JERROLD NELSON, IV, Montreal, Quebec B.S., McGill University, 1948	222 Varnum Avenue
GREEN, ARTHUR NORMAN, IV, Lowell, Mass. B.S., Brown University, 1949	56 Chauncey Avenue
HALLETT, RICHARD LIBBY, VI, Lowell, Mass. B.S., Lowell Textile Institute, 1949	98 Wannalancit Street
HORWITCH, ARNOLD MURRAY, V, Chicago, Ill. Ph.B., University of Chicago, 1948	302 Smith Hall
KOPYCINSKI, JOSEPH VALENTINE, IV, Lowell, Mass. B.S., Lowell Textile Institute, 1948	242 Branch Street
[1]KORMOS, PETER MARION, V, Lowell, Mass.	205 Stackpole Street
KUO, TOM TUNG, VI, Shanghai, China B.S., Chen-Fu Textile College, 1943	12 Warwick Street
LAKSHMINARAYANAIAH, NALLANNA IV, Bangalore City, India M.S., Benares Hindu University, 1945	27 Waverly Street
LONGNECKER, KENNETH WILLIAM, LTJG, SC, USN, VI, Erie, Pa. B.S., United States Naval Academy, 1944	North Billerica
NIEH, CHUNG SAN, VI, Shanghai, China B.S., National Chiao-Tung University, 1949	306 Smith Hall
O'NEIL, JOHN JOSEPH, JR., VI, Arlington, Mass. B.S., Tufts College, 1947	406 Pawtucket Street
PATTON, GERALD JACKSON, LTJG, SC, USN, VI, Anadarko, Okla. B.S., United States Naval Academy, 1944	Dracut
PETERSEN, RICHARD EDWARD, IV, Concord, Mass. B.S., Lowell Textile Institute, 1947	
[1]PFISTER, DAVID HERBERT, V, Lynbrook, N. Y.	31 Waverly Avenue

Home Address	*College Address*
Rose, Edgar, VI, Lowell, Mass. M.S., Massachusetts Institute of Technology, 1948	38 Endicott Street
Sheehan, Charles Russell, IV, Lowell, Mass. B.S., Lowell Textile Institute, 1949	374 Adams Street
Skalkeas, Basil George, IV, Lowell, Mass. B.S., Lowell Textile Institute, 1941	29 Gershom Avenue
Smith, James Aaron, LTJG, SC, USN, VI, Norfolk, Va. B.S., United States Naval Academy, 1944	21 Dunbar Avenue
[1]Stavrakas, Evangelos, V, Brooklyn, N. Y.	31 Waverly Avenue
Strum, Louie Willard, Jr., LCdr, USN, VI, Jacksonville, Fla. B.S., United States Naval Academy, 1940	North Chelmsford
Trommer, Charles Richard, IV, New York, N. Y. B.S., Lowell Textile Institute, 1949	392 Chelmsford Street
Wang, Hsuan Sun, IV, Shanghai, China B.S., St. John's University, 1946	222 Textile Avenue
Woo, Henry Kyi-oen, VI, Shanghai, China M.S., Lowell Textile Institute, 1948	56 Fourth Avenue

[1] Candidate for the degree of Bachelor of Science in Textile Manufacturing, June, 1950.

OFFICERS TEXTILE TRAINING COURSE

Covington, James Coxe, Major, USA, VI, Columbia, S. C. B.S., Clemson Agricultural and Mechanical College, 1939	North Chelmsford
Everton, Theme Troy, Capt., USA, VI, San Pedro, Calif. B.S., University of Southern California, 1942	North Chelmsford
Greene, Alfred Thomas, Lt. Col., USMC, VI, Pass-a-Grille Beach, Fla. Colorado School of Mines	Chelmsford
Martin, Marlin Clack, Jr., Major, USMC, VI Dobbs Ferry, N. Y. A.B., Lafayette College, 1940	184 Hildreth Street

SPECIAL STUDENTS

Aronson, James Otis, A.B., IV, Newton, Mass.	
Barrett, James Joseph, A.B., II, Waban, Mass.	209 Smith Hall
Clayton, Harold Edmund, Jr., M.C.S., III, Lowell, Mass.	122 Eleventh Street
Emmons, John Grimes, B.S., VII, Arlington, Mass.	
Leon, Seymour, B.S., II, Brooklyn, N. Y.	234 Nesmith Street
Rojas, Gustavo Maturana, C.E., IV, Conception, Chile	109 Smith Hall
Tait, James Ballantyne, Jr., B.A., Janesville, Wis.	209 Smith Hall

UNDERGRADUATE STUDENTS

Holders of scholarships are indicated by the asterisk (*), while the daggers (†) (‡) indicate the Dean's List for the second semester of 1948-1949 and for the first semester of 1949-1950 respectively.

CLASS OF 1950

Home Address	*College Address*
ABBOTT, GEORGE AMOS, II, Malden, Mass.	466 Bridge Street
ADLER, KENNETH MYRON, VI, Brooklyn, N. Y.	93 Dover Street
†‡ANDREWS, HUGH HILL, VI, Andover, Mass.	———
ANGELO, PAUL JOSEPH, JR., VII, Lowell, Mass.	50 Woodward Avenue
†‡AUGSBURGER, GERARDO RAINER, I, Buenos Aires, Argentina	59 Arlington Street
BECKER, RICHARD JOHN, I, Lowell, Mass.	58 Thirteenth Street
BESSO, MICHAEL MAURICE, IV, Brooklyn, N. Y.	109 Mammoth Road
†BLAGMAN, BURTON, IV, Brooklyn, N. Y.	77 Livingston Avenue
BONCZAR, THADDEUS JOSEPH, VI, Lowell, Mass.	130 Jewett Street
*†‡BOOK, BERNARD SAMUEL, III, Bronx, N. Y.	263 Princeton Boulevard
BOUDREAU, PAUL VICTOR, IV, Lowell, Mass.	295 Riverside Street
BOWDEN, ALANSON WALKER, JR., II, Stow, Mass.	———
BRECK, WENDELL HERBERT, II, Dracut, Mass.	———
†BRESSLER, SIDNEY WALLACE, III, Brockton, Mass.	77 Livingston Avenue
BRITTON, EDWARD JOSEPH, IV, Lowell, Mass.	21 Hurd Street
*†‡BROWN, JUDITH ANNE, IV, Georgetown, Mass.	16 Nelson Avenue
†BROWN, WALTER MADISON, II, Worcester, Mass.	392 Chelmsford Street
BROWNELL, SUMNER IVES, I, Moodus, Conn.	262 Pawtucket Street
†‡BRUNELLE, NORMAN MATTHEW, IV, Fitchburg, Mass.	379 Chelmsford
CALLAN, STEPHEN SMITH, VI, Reading, Mass.	———
CANOVA, ALFRED WILLIAM, II, Holyoke, Mass.	31 Waverly Avenue
CARPENTER, BRYANT LOCKE, VI, Rockland, Mass.	228 Varnum Avenue
†‡CARTER, FRED DOLGE, III, Millbury, Mass.	31 Waverly Avenue
CASEY, JOHN GERARD, II, Pittsfield, Mass.	406 Pawtucket Street
CASEY, THOMAS GARRETT, IV, Lowell, Mass.	8 Gates Street
†CASTORIANO, CLAUDE EMMANUEL, I, Lima, Peru	408 Smith Hall
CHADWICK, THOMAS NIELSON, VI, Lowell, Mass.	57 Robbins Street
†CHAO, PEI CHUNG, I, Shanghai, China	12 Warwick Street
CHENG, FUR SHE, I, Shanghai, China	5 White Street
CLIFFORD, STANLEY JOSEPH, II, West Roxbury, Mass.	406 Pawtucket Street
†‡COMMERFORD, THERESE RITA, IV, Lowell, Mass.	29 Starbird Street
COPP, ALBERT RAYMOND, IV, Hudson, Mass.	———
†‡CUMMINGS, ROBERT EDWARD, VII, Enfield, Conn.	406 Pawtucket Street
DERBY, JAMES HENRY, II, Lawrence, Mass.	———
†‡DOUGLAS, WARREN DANA, VI, Lowell, Mass.	30 Burgess Street

Home Address	*College Address*
†‡Dubin, Paul, II, Worcester, Mass.	110 Smith Hall
Earls, Robert Kimball, VI, Southbridge, Mass.	406 Pawtucket Street
†Ellis, Lawrence Francis, II, Melrose, Mass.	406 Pawtucket Street
Ellis, Ralph Jefford, VI, Marshfield Hills, Mass.	752 Andover Street
Evans, John, IV, East Boston, Mass.	31 Waverly Avenue
Evans, William George, IV, East Boston, Mass.	Littleton
Farley, Glenn Robert, II, North Andover, Mass.	———
Feinman, Jerome Harold, VI, New York, N. Y.	32 Orchard Street
Feldman, Manuel David, V, Lynn, Mass.	320 Wilder Street
†Feyler, Donald Pearson, IV, Chelmsford, Mass.	———
†‡Feyler, Irving Wyman, Jr., IV, Chelmsford, Mass.	———
†Fifield, Richard Tyler, VI, Melrose, Mass.	406 Pawtucket Street
†Fillmore, Malcolm Graham, Jr., VI, Nashua, N. H.	———
*†‡Fishback, Joseph, V, Bell Harbor, N. Y.	77 Livingston Avenue
Fleisher, Conrad Gerald, IV, Watertown, Conn.	365 Wilder Street
†Flister, Walter Edwin, IV, Hyde Park, Mass.	423 Pawtucket Street
†Fowle, Frederick Jordon, II, Wellesley, Mass.	———
*†‡Fox, Julius Ira, VII, Philadelphia, Pa.	55 Huntington Street
‡Gaidis, Leo Peter, IV, Lawrence, Mass.	———
Gaon, Harry, VI, Montreal, Canada	77 Livingston Avenue
Gellis, Donald Ian, VI, Laurelton, N. Y.	53 Mt. Hope Street
†Glass, Arthur Marvin, VI, Providence, R. I.	32 Orchard Street
‡Glassman, Herbert, II, Boston, Mass.	272 Merrimack Street
Godet, John Russell, IV, Lowell, Mass.	10 Fenwick Terrace
†‡Goldman, Alfred Yale, V, Chelsea, Mass.	———
Goldman, Sumner Bernard, I, Roxbury, Mass.	12 Warwick Street
Gouveia, Adelino Peter, IV, Lowell, Mass.	161 Lawrence Street
*†‡Gregg, Joan Louise, IV, Lowell, Mass.	1867 Middlesex Street
Grochmal, Stanley Joseph, IV, Lowell, Mass.	46 Albion Street
†Hacker, Morton, VI, Lowell, Mass.	7 Rockdale Avenue
Halligan, Raymond Earl, IV, Lowell, Mass.	47 Barclay Street
Hekker, Frank Henry, IV, Rutherford, N. J.	406 Pawtucket Street
Herbert, Erwin Lori, VI, Elizabeth, N. J.	37 Georgia Avenue
Higgins, William Eugene, VI, Lowell, Mass.	3 Forest Avenue
*†‡Hornyak, Frederick Matthew, IV, Philadelphia, Pa.	12 Crawford Street
Kaufman, David Leonard, II, Brooklyn, N. Y.	100 Mt. Washington St.
†‡King, Richard McClain, VII, Shawnee, Okla.	409 Smith Hall
†‡Koffman, Leonard Saunders, III, Boston, Mass.	14 Oakland Street
Koksal, Lutfi, VI, Istanbul, Turkey	123 Riverside Street
†‡Kormos, Peter Marion, V, Lowell, Mass.	205 Stackpole Street

Home Address	*College Address*
†Koshak, Daniel Theodore, IV, Brooklyn, N. Y.	262 Adams Street
†LaRiviere, Stephen Gerard, III, Southbridge. Mass.	28 Fourth Street
†‡Laureti, Remo Joseph, VI, Quincy, Mass.	84 Methuen Street
†Lebowitz, Myer, VI, Boston, Mass.	272 Merrimack Street
*†‡Leitgeb, Donald Joseph, V, Waldwick, N. J.	406 Pawtucket Street
*‡Lemire, Gabrielle Marie, IV, Lowell, Mass.	52 Colonial Avenue
†‡Levinson, Arthur David, VI, Brooklyn, N. Y.	365 Wilder Street
†‡Lord, Edwin Lincoln, Jr., VI, West Medford, Mass.	112 Smith Hall
McCarron, Dorothy Anne, IV, Lowell, Mass.	416 Rogers Street
*†‡McElrath, Regina Mark, III, Great Barrington, Mass.	123 Riverside Street
McGowan, Malcolm, IV, Lowell, Mass.	55 Marlborough Street
Mahoney, Herbert Francis, IV, Winchester, Mass.	406 Pawtucket Street
Manning, Edward, IV, Cambridge, Mass.	406 Pawtucket Street
†March, Peyton Conway, VI, Lowell, Mass.	20 West Sixth Street
Martin, James, VI, Lowell, Mass.	53 Fay Street
†‡Matlin, Nathaniel Abraham, IV, Lowell, Mass.	48 Gates Street
‡Meltzer, Richard Morris, VII, Hewlett, L. I., N. Y.	
Merrill, Allen Robert, VI, Tewkhbury, Mass.	272 Merrimack Street
Merrill, Richard Douglas, I, Chelmsford, Mass.	———
†Middleton, Donald Whiting, VI, Rehoboth, Mass.	———
Milgrim, Seymour, V, Brooklyn, N. Y.	12 Crawford Street
*†‡Miller, James Edward, IV, Leavenworth, Kans.	203 Smith Hall
Morrison, Robert Eugene, IV, Dracut, Mass.	12 Crawford Street
Newman, Jerome Leonard, VI, Brooklyn, N. Y.	———
O'Donoghue, John Francis, Jr., II, Belmont,	452 Fletcher Street
†‡O'Krafka, Alfred Ernest, II, Hespeler, Ontario	406 Pawtucket Street
Paul, Vito John, VI, Methuen, Mass.	75 Smith Street
*Peterson, John Samuel, VI, Andover, Mass.	———
†‡Pfister, David Herbert, V, Lynbrook, N. Y.	———
Pong, William, I, Pine Bluff, Arkansas	31 Waverly Avenue
†Priestly, Joseph Amos, VI, Lowell, Mass.	137 Riverside Street
Profio, Samuel Camillo, IV, Lowell, Mass.	8 Gage Avenue
†‡Proulx, Raymond Elphege, III, Lowell, Mass.	1878 Middlesex Street
Ramsbottom, John Dana, Jr., I, Fall River, Mass.	17 Dodge Street
*†‡Rebenfeld, Ludwig, IV, Lowell, Mass.	406 Pawtucket Street
Reines, William, IV, Poughkeepsie, N. Y.	263 Princeton Boulevard
Richardson, Donald Forrest, VI, Lowell, Mass.	365 Wilder Street

Home Address	*College Address*
†‡Rivollier, Elie, Jr., V, Clinton, Mass.	42 Woodward Terrace
Rodgers, Charles Joseph, Jr., IV, Lowell, Mass.	211 Smith Hall
†‡Rudes, Sidney, V, Brooklyn, N. Y.	14 Dumerle Street
Rudolf, Mitchell Joseph, VI, Lowell, Mass.	213 Smith Hall
Ruffenach, Stephen Clifford, IV, Paterson, N. J.	5 Hazel Square
Samdperil, Albert, VII, Providence, R. I.	98 Stevens Street
Sampson, Walter Stewart, Jr., VII, Belmont, Mass.	50 Wellesley Avenue
†Sheroff, Robert Murray, I, Dorchester, Mass.	———
†Shires, William Stanley, VI, Lowell, Mass.	———
*†‡Sloan, Robert Hood, VI, Tewksbury, Mass.	18 Gage Avenue
†‡Smaha, Herbert Joseph, IV, Methuen, Mass.	———
Snow, Ralph Frank, VI, Montreal, Quebec	———
†‡Spicer, George William, IV, Lowell, Mass.	752 Andover Street
*†‡Stavrakas, Evangelos, V, Brooklyn, N. Y.	19 Rhodora Street
†Struzik, Frank Broneslaw, VI, Woonsocket, R. I.	31 Waverly Avenue
†Sweetser, Paul Ashton, VII, North Quincy, Mass.	215 Eames Hall
Tattersall, James, VI, Toronto, Ontario	Dracut
†Weiner, Charles Richard, III, Brooklyn, N. Y.	169 Wentworth Avenue
‡Welcome, William Francis, IV, Lowell, Mass.	77 Livingston Avenue
Weldon, Joseph Edward, IV, Lowell, Mass.	105 Lauriat Street
†West, Albert George, VI, Whitinsville, Mass.	72 Lafayette Street
†‡Williams, John Woodburn, II, Perth, Ontario	406 Pawtucket Street
*†Wirth, Allan Robert, IV, Methuen, Mass.	406 Pawtucket Street
†‡Woidzik, Albert Thomas, VI, Pringle, Pa.	———
Yumlu, Mustafa Ekrem, IV, Istanbul, Turkey	35 Varnum Avenue

CLASS OF 1951

Abbot, Edward Mosley, Jr., II, Westford, Mass.	
Abrahamson, David Marshall, III, Worcester, Mass.	272 Merrimack Street
*†‡Ames, Irwin Maxwell, VI, Brooklyn, N. Y.	210 Smith Hall
†‡Aronowitz, Marvin, VI, Paterson, N. J.	100 Riverside Street
†‡Arsham, Martin David, II, Cleveland Heights, Ohio	285 Stevens Street
†Athas, Stanley Theodore, VI, Lowell, Mass.	138 Bowers Street
†‡Bazakas, Apostolos Christos, II, Marlboro, Mass.	37 Varney Street
Belsik, Paul Harold, VII, Averne, N. Y.	77 Livingston Avenue
†Berwick, Robert Lloyd, VI, Meriden, Conn.	77 Livingston Avenue
Bickford, Robert Donald, II, Lowell, Mass.	84 Bellevue Street
‡Bischoff, Frederick Bedell, VI, Wilmington, Mass.	———

Home Address	College Address
†Bloomenfeld, Joseph Meyer, VI, Bedford, Mass.	———
Boghosian, Nishan, V, Whitinsville, Mass.	31 Waverly Avenue
†‡Brown, Frederick Donald, IV, Lowell, Mass.	24 Viola Street
Buchanan, Warren Thomas, VI, North Chelmsford, Mass.	———
	———
†Bussiere, Robert William, III, Pittsfield, Mass.	31 Waverly Avenue
†‡Cahano, Abraham, VI, Tel-Aviv, Israel	187 Textile Avenue
Cassidy, Paul Conlon, IV, Lowell, Mass.	182 Wentworth Avenue
†‡Cate, Alfred Louis, IV, Lawrence, Mass.	———
Charewicz, Joseph Henry, II, Lawrence, Mass.	———
Churchville, Joseph John, II, Townsend, Mass.	406 Pawtucket Street
Cohen, Stanley Robert, VI, Newton Highlands, Mass.	411 Smith Hall
†‡Coombes, Richard William, VI, Tewksbury, Mass.	———
†Corcoran, Henry James, Jr., II, Newton Lower Falls, Mass.	53 Mt. Hope Street
†‡Cottrell, Robert Charles, V, Lowell, Mass.	103 South Walker Street
†[1]Covington, Frederick Arthur, IV, Lowell, Mass.	1268 Middlesex Street
†‡Craven, Francis Joseph, Jr., IV, Lowell, Mass.	620 School Street
†‡Creegan, Robert Michael, IV, Lowell, Mass.	31 Morey Street
Cushman, Paul Swan, VI, Glens Falls, N. Y.	410 Eames Hall
Daveau, Norman Oliver, II, Webster, Mass.	53 Mt. Hope Street
†‡Davis, Evans Reade, VI, Toronto, Ontario	16 Tyler Park
*†‡Denio, Ruth Elinor, IV, Lowell, Mass.	129 B Street
†Descoteaux, Paul Maurice, VI, Lowell, Mass.	104 Cabot Street
Ducharme, Joseph James, IV, Lowell, Mass.	166 Smith Street
*†Duncan, Blair Robertson, VI, Easthampton, Mass.	315 Smith Hall
Dupuis, Amedee James, VI, Lowell, Mass.	26 Fremont Street
‡Eidlitz, Thomas, III, New York, N. Y.	212 Smith Hall
Eklund, Clinton Louis, VI, Lowell, Mass.	137 Midland Street
*†Feitelson, Herbert William, VII, New York, N. Y.	53 Mt. Hope Street
Ferron, Richard Edward, VI, Belmont, Mass.	———
*†‡Finkelstein, Martin Isaac, IV, Paterson, N. J.	Chelmsford
Fitzgerald, Robert Antoin, II, Belmont, Mass.	———
Freeman, Robert Herbert, IV, Brooklyn, N. Y.	452 Fletcher Street
French, Gerald William, VI, Lowell, Mass.	55 Varnum Street
†‡Gale, Norman Donald, VII, St. Louis, Mo.	218 Gibson Street
†‡Gilman, Leonard Irwin, IV, Dorchester, Mass.	———

[1] Died November 25, 1949

Home Address	*College Address*
GINSBURG, ALAN, IV, Brooklyn, N. Y.	77 Livingston Avenue
†GIROUARD, PAUL CHARLES, VI, Boston, Mass.	406 Pawtucket Street
GLIDDEN, JOHN EDWIN, II, Ashland, N. H.	100 Mt. Washington St.
GOLDBERG, MURRAY MYLES, VII, Manchester, N. H.	77 Livingston Avenue
*†‡GOODWIN, DORRANCE HAVEN, VI, Sanford, Maine	Westford
GORECKI, CHARLES EDWARD, VI, Haverhill, Mass.	———
†‡GOULEKAS, CHARLES ANDREW, VI, Lowell, Mass.	67 Varney Street
*†‡GREENBERG, GERALD MARK, IV, Brooklyn, N. Y.	1268 Middlesex Street
†‡GUIDOTTI, ALFRED EDWARD, II, Lowell, Mass.	31 Waverly Avenue
†HALEY, PHILIP WESLEY, VI, Quincy, Mass.	46 Thirteenth Street
*†‡HALPERN, MELVIN ARTHUR, VI, New York, N. Y.	365 Wilder Street
HAYES, JOHN THOMAS, VI, Cambridge, Mass.	———
HIGGINS, THOMAS DAVID, VI, Milton, Mass.	100 Riverside Street
†‡HIRSCHORN, GERARD, VI, Brooklyn, N. Y.	187 Textile Avenue
†HOCHBERG, EDWARD GEORGE, VI, Paterson, N. J.	50 Standish Street
HOLMBERG, HARRY HARMON, V, Milford, Mass.	31 Waverly Avenue
*†‡JACKLE, ROGER WILLIAMS, II, Springfield Gardens, N. Y.	31 Waverly Avenue
JOHNSON, PAUL LESTER, VI, Dorchester, Mass.	100 Mt. Washington St.
KARPOFF, DAVID, II, New York, N. Y.	173 Branch Street
KEITH, RICHARD CANOVER, II, Putnam, Conn.	272 Merrimack Street
†‡KELLEHER, JOHN JAMES, IV, Lowell, Mass.	14 Prince Terrace
KELLEY, EDWARD FRANCIS, II, No. Billerica, Mass.	———
KNIGHT, JOHN HENRY, II, Billerica, Mass.	———
†KOHNFELDER, CHARLES HARRY, VI, Lowell, Mass.	392 Chelmsford Street
KOSOWICZ, WALTER JOHN, IV, Lowell, Mass.	5 Jewett Street
LABRECQUE, LEO EUGENE, IV, Lawrence, Mass.	———
†‡LANDIS, MELVIN BERNARD, VI, Springfield, Mass.	117 Grand Street
LATKOWITCH, SYDNEY ABRAHAM, VI, Chelsea, Mass.	———
LAWSON, WAYNE HERBERT, IV, Tewksbury, Mass.	———
LEVENSON, ALBERT MILTON, IV, Mattapan, Mass.	215 Smith Hall
*†LINBERG, CHARLES FRANCIS, VI, Carney's Point, N. J.	410 Eames Hall
†‡LITTLE, CHARLES ABBOTT, III, Winthrop, Mass.	137 Riverside Street
†‡LUBA, MARVIN, VII, Brooklyn, N. Y.	77 Livingston Avenue
*†‡LYONS, ALLAN STUART, VII, New York, N. Y.	303 Smith Hall
†‡MCKONE, HENRY JAMES, VI, Lowell, Mass.	27 Woodward Avenue
MCKONE, THOMAS JOSEPH, IV, Dracut, Mass.	———
MAGUIRE, THOMAS JOSEPH, VI, Lowell, Mass.	31 Prospect Street
MAJEUNE, GASTON CHRISTIAN, IV, Haverhill, Mass.	272 Merrimack Street
*†MENZIES, WILLIAM CORNET, JR., VI, Adams, Mass.	31 Waverly Avenue
MERRILL, GEORGE LESLIE, IV, Lowell, Mass.	2026 Middlesex Street

Home Address	*College Address*
*†Merrill, Kenneth Stephen, VI, Lowell, Mass.	364 Varnum Avenue
*Miller, Arthur Paul, VI, Salt Lake City, Utah	137 Riverside Street
†Miller, Kenneth Edward, II, Lawrence, Mass.	64 Mt. Hope Street
†Monaco, Albert Thomas, VI, Lowell, Mass.	84 Methuen Street
†Morris, Edward Sharon, III, Paterson, N. J.	77 Livingston Avenue
Mountain, Harold Ronald, II, Dexter, Maine	31 Waverly Avenue
Murmes, Leonard, II, Brighton, Mass.	———
Murphy, Roger James, VI, North Uxbridge, Mass.	31 Waverly Avenue
†‡Needle, Irwin Reuben, III, Brooklyn, N. Y.	77 Livingston Avenue
*†‡Newell, Kenneth Bernard, VI, Troy, N. Y.	102 Smith Hall
Nickerson, Earl James, V, Chelmsford, Mass.	———
Noonan, Joseph Donald, IV, Lowell, Mass.	29 Forest Street
†O'Donnell, William Robert, VI, Lowell, Mass.	11 Hazeltine Street
†‡Pantell, Ira Harry, III, New York, N. Y.	77 Livingston Avenue
Panto, Joseph Salvatore, IV, Lawrence, Mass.	64 Mt. Hope Street
Patrick, Kit Carson; III, Andover, Mass.	———
Pelliccione, Gregory Joseph, IV, Lawrence, Mass.	———
Pihl, Donald Greenwood, VI, Lowell, Mass.	11 Stromquist Avenue
Pofcher, Wilmer, III, Lowell, Mass.	376 Westford Street
Quinn, Raymond John, IV, Lowell, Mass.	314 Wentworth Avenue
Rawitz, Leonard, VII, Lowell, Mass.	392 Chelmsford Street
*†‡Reilly, Frank Thomas, I, Maplewood, N. J.	315 Eames Hall
*†‡Roberts, Richard Seymour, VI, Brooklyn, N. Y.	77 Livingston Avenue
†‡Robson, Daniel Riggs, III, Lowell, Mass.	577 School Street
Rosenkrantz, Stanley, I, Pottsville, Pa.	52 Princeton Boulevard
Rostler, Seymour Stone, VII, Lowell, Mass.	31 Holden Street
*†Rowe, Peter Marcel, III, Paterson, N. J.	42 South Walker Street
†Ryan, William Eugene, VII, Rankin, Ill.	31 Waverly Avenue
†Ryan, Lawrence Francis, Jr., VI, Carney's Point, N. J.	30 Riverside Street
†‡Salomon, Jay Stuart, VI, Brooklyn, N. Y.	39 Dover Street
‡Schlaginhaufen, Eric Alan, IV, North Bergen, N. J.	406 Pawtucket Street
‡Schrager, Jerome Stanley, V. Brooklyn, N. Y.	100 Riverside Street
Seigel, Hersch David, II, Brookline, Mass.	77 Livingston Avenue
*†Shapley, Harvey David, I, Great Neck, N. Y.	52 Princeton Boulevard
‡Shaughnessy, Robert Kenton, IV, Lowell, Mass.	18 Puffer Street
Shenkar, Shmaryahu, VI, Tel-Aviv, Israel	272 Merrimack Street
†‡Sherburne, Edwin Collier, IV, Tyngsboro, Mass.	———
†Sheroff, Melvin Saul, II, Dorchester, Mass.	———
†‡Silver, Bernard, III, Worcester, Mass.	25 Princeton Boulevard

Home Address	*College Address*
Socransky, Morris Harvey, II, Montreal, Quebec	37 Georgia Street
Solov, Leonard, II, Newton Center, Mass.	239 Stevens Street
Spencer, Robert Weeks, II, Saylesville, R. I.	37 Varney Street
Squire, Charles, VI, Glen Cove, N. Y.	64 Tyler Park
Stein, Alfred Eugene, VII, Astoria, L. I., N. Y.	77 Livingston Avenue
†‡Sternlieb, Herschel, V, Brookline, Mass.	320 Wilder Street
†‡Sumers, Robert Warren, IV, San Diego, Calif.	Chelmsford
Swiatek, Henry John, IV, Methuen, Mass.	
Teta, Walter Michael, III, Brooklyn, N. Y.	299 Princeton Boulevard
Teubal, Michael Neville, II, Buenos Aires, Argentina	40 Riverside Street
†Trilling, Theodore Roosevelt, Jr., II, Woodmere, N. Y.	287 Stevens Street
Tully, Francis Paul, IV, Lowell, Mass.	24 Light Avenue
Tully, Paul Raymond, IV, Lowell, Mass.	249 Third Street
Tung, Cheng-Yu, I, Shanghai, China	56 Fourth Avenue
†‡Wang, James Paul, I, Shanghai, China	28 Riverside Street
†‡Weldon, Arthur Joseph, VI, Lowell, Mass.	53 Warwick Street
†Whitney, Kenneth Lincoln, II, Pittsfield, Mass.	37 Varney Street
*†‡Whitworth, James Webster, IV, Chelmsford, Mass.	———
Wiener, Donald, IV, New Britain, Conn.	365 Wilder Street
Wilkinson, John Stewart, VI, North Andover, Mass.	———
†‡Wood, Samuel Anthony, IV, North Adams, Mass.	152 Grove Street
Wulf, Melvin Lawrence, VII, Troy, N. Y.	77 Livingston Avenue

CLASS OF 1952

Aldrich, Donald Winthrop, III, North Tewksbury, Mass.	———
Allen, Curtis Carleton, II, Milton, Mass.	31 Waverly Avenue
Allison, John Harold, VI, North Andover, Mass.	———
Ames, Irwin Maxwell, VI, Brooklyn, N. Y.	210 Smith Hall
Aptaker, Erwin Malcolm, VII, Revere, Mass.	———
†‡Aronson, Richard Lee, V, Great Neck, N. Y.	25 Princeton Boulevard
Arsham, Martin David, II, Cleveland Heights, Ohio	285 Stevens Street
Averbach, Howard Lee, I, Mattapan, Mass.	———
Axon, Gordon Lyle, IV, Chelmseford, Mass.	———
‡Barr, Robert Sutherland, VI, Amesbury, Mass.	415 Smith Hall
‡Barry, Gerald Francis, IV, Lowell, Mass.	262 Adams Street
Beaulier, Vernon James, VIII, Lowell, Mass.	379 Chelmsford Street
‡Becker, Marvin Franklin, V, Brooklyn, N. Y.	77 Livingston Avenue
Becker, Robert Ivan, VI, Leicester, Mass.	31 Waverly Avenue
Belanger, Wilfred Edmond, IV, Lowell, Mass.	18 Fisher Street

Home Address	*College Address*
†‡Bell, Gilbert Carter, VI, Lowell, Mass.	71 Robbins Street
†Benjamin, Albert, III, Brooklyn, N. Y.	402 Smith Hall
*†‡Bernstein, Milton Jacob, III, Paterson, N. J.	111 Smith Hall
Bethel, Charles Huggard, V, Great Neck, N. Y	100 Mt. Washington St.
Bird, Marshall Coles, II, Rochester, N. H.	103 Smith Hall
Bloch, Manfred G., VI, Tel Aviv, Israel.	308 Smith Hall
Boches, Milton, IV, Lowell, Mass.	38 Bellevue Street
†‡Bodor, Stephen Joseph, VI, Lynn, Mass.	401 Smith Hall
Brewer, Kenneth Harvey, II, Manchester, N. H.	314 Smith Hall
†‡Brissette, Richard Stacy, VI, Rockford, Ill.	201 Smith Hall
†‡Bromley, John Eberbach, III, VI, Glenside, Pa.	101 Smith Hall
Brown, Harold Stacy, VI, Lowell, Mass.	31 Waverly Avenue
Brown, Perry Horton, VI, Marblehead, Mass.	108 Smith Hall
*†Bussiere, Kirk, III, Pittsfield, Mass.	211 Smith Hall
Carroll, William Henry, III, Medford, Mass.	208 Smith Hall
Claridge, Arthur Whittier, VI, Marlboro, Mass.	312 Smith Hall
†Coffin, Laurence Gregory, VI, Port Chester, N. Y.	312 Smith Hall
†Delaney, Francis Lawrence, VI, Forge Village, Mass.	———
‡Dersh, Harvey Arthur, VI, Brooklyn, N. Y.	405 Smith Hall
*†‡Desrochers, Roland Joseph, VI, Franklin, N. H.	311 Smith Hall
†‡Dickison, Bruce Osborne, IV, Lowell, Mass.	48 E Street
†‡Donoian, Haig Cadmus, IV, Lowell, Mass.	44 Elm Street
‡Dooley, Donald David, IV, Lowell, Mass.	799 Chelmsford Street
Draper, Richard Leonard, I, Hopedale, Mass.	31 Waverly Avenue
Eklund, Richard Thorp, IV, Lowell, Mass.	1128 Bridge Street
Engel, Richard Brom, V, Elmhurst, L. I., N. Y.	140 Oakland Street
†‡Engelhardt, Bernard Herbert, VI, Brooklyn, N. Y.	402 Smith Hall
Feinberg, Bertram, III, Forest Hills, N. Y.	100 Riverside Street
†‡Finegold, Donald Erwin, IX, Peabody, Mass.	210 Smith Hall
Fulginiti, Panteleone Samuel, VI, Worcester, Mass.	314 Smith Hall
†Galas, Albion Henry, VI, Monson, Mass.	North Reading
Gellene, Alfred Vincent, V, Paterson, N. J.	406 Pawtucket Street
Giard, Edward Henry, IV, Peterboro, N. H.	208 Smith Hall
Girard, Roger Donald, V, Lowell, Mass.	199 Emery Avenue
Gladstone, Milton Harvey, V, Brooklyn, N. Y.	100 Riverside Street
Goven, Earl Joseph, I, Wauregan, Conn.	Chelmsford
Grady, Douglas Francis, I, Palisades Park, N. J.	406 Pawtucket Street
Graham, Everett Henderson, VI, Graniteville, Mass.	

Home Address	*College Address*
Greeley, Richard Francis, VI, Chelmsford, Mass.	
*†‡Grill, Joel Harvey, VI, Brooklyn, N. Y.	407 Smith Hall
Haddad, Herbert Lawrence, VI, Iselin, N. J.	406 Pawtucket Street
Hausman, Richard Demarer, V, Kings Point, L. I., N. Y.	307 Smith Hall
†‡Hixon, Wesley Francis, I, Hopedale, Mass.	304 Smith Hall
Hochfeld, Michael, IV, New York, N. Y.	222 Varnum Avenue
Hochner, Walter Leo, IV, Kew Gardens, N. Y.	222 Varnum Avenue
†Hocking, Winfred Thomas, VI, Melrose, Mass.	413 Smith Hall
Ivanowicz, Michael, III, Blackstone, Mass.	142 Riverside Street
Jaciuk, Donald Anthony, VI, Lowell, Mass.	56 W. Fourth Street
Jouret, John Edward, II, Andover, Mass.	———
†Kalantzakos, Nicholas, VI, Lowell, Mass.	44 Adams Street
Kaye, Irwin, Richard, VII, Brookline, Mass.	203 Smith Hall
Kaye, Michael Bondy, V, New York, N. Y.	77 Livingston Avenue
*Keenan, Ursula Frances, III, South Boston, Mass.	90 Riverside Street
†‡Komins, Burton Louis, IV, Brookline, Mass.	414 Smith Hall
Koza, Walter Mitchell, VI, Lowell, Mass.	152 Lakeview Avenue
Kupferman, Arthur, VI, Bronx, N. Y.	204 Smith Hall
Lanciault, George Ernest, IV, Ware, Mass.	311 Smith Hall
Langlais, Roger John, IV, Lowell, Mass.	48 Riverside Street
LaPlante, Richard Haynes, IV, Lowell, Mass.	31 Eleventh Street
Lee, Laurence Chih-liang, I, Shanghai, China	28 Riverside Street
†Lein, Sherman, IV, Brooklyn, N. Y.	414 Smith Hall
Lemire, John Emile, II, Lowell, Mass.	52 Colonial Avenue
Levenson, Richard Norman, VII, Brookline, Mass.	215 Smith Hall
Levy, Simon, V, Brooklyn, N. Y.	409 Smith Hall
†‡Lewis, Francis Augustus, VI, East Dedham, Mass.	207 Smith Hall
‡Lewis, Roger Alan, VI, Chelmsford, Mass.	———
Liacopoulos, Nicholas Constantine, VI, Lowell, Mass.	185 Mt. Vernon Street
*†‡Liston, Florence Patricia, IV, Lowell, Mass.	28 Bellevue Street
*†Longbottom, Parker Wyman, IV, Claremont, N. H.	103 Smith Hall
‡Lynch, William Paul, VI, Lowell, Mass.	85 Sherman Street
McCartney, Donald James, IV, Lowell, Mass.	76 Cambridge Street
†‡McEwen, Thomas Arthur, II, Webster, Mass.	410 Smith Hall
‡McKeon, Richard Francis, VI, North Adams, Mass.	Tyngsboro
†‡MacLean, Harold John, VI, Lowell, Mass.	118 Myrtle Street
McNulty, Denis Michael, II, Dorchester, Mass.	———
Mack, Charles Harris, VII, Cape Elizabeth, Maine	50 Standish Street

Home Address	*College Address*
Madans, Jerome Irwin, V, New York, N. Y.	309 Smith Hall
Meehan, David Justin, I, Providence, R. I.	100 Washington Street
Mettler, Edward, VI, Forest Hills, L. I., N. Y.	222 Varnum Avenue
†‡Michalowski, Kadzimiez Sylvester, II, North Bellingham, Mass.	304 Smith Hall
Mills, Harold George, I, Auburn, Maine	114 Smith Hall
Montgomery, Richard Howlett, VI, Chelmsford, Mass.	———
*Morris, Joseph Charles, VI, Long Beach, N. Y.	25 Princeton Boulevard
†‡Moss, Harry, Jr., VI, Whitinsville, Mass.	101 Smith Hall
Mullen, Arthur Leo, Jr., II, Dedham, Mass.	102 Jenness Street
*Musman, Bernard, VI, Brooklyn, N. Y.	403 Smith Hall
†‡Nelson, Charles David, VI, Groveland, Mass.	———
Nestervich, Michael, III, Claremont, N. H.	214 Smith Hall
Nogueira, Alberto DeVasconcelos, I, Maceio-Alagoas, Brazil	301 Smith Hall
O'Donnell, John Thomas, IV, Lowell, Mass.	11 Hazeltine Street
O'Leary, Thomas Francis, I, Belmont, Mass.	413 Smith Hall
†‡Olney, Robert Albert, IV, Forest Hills, L. I., N. Y.	310 Smith Hall
Pecci, Raymond Peter, IV, Lawrence, Mass.	———
†‡Peters, Margaret Jean, IV, Lowell, Mass.	163 Fort Hill Avenue
Platt, James Rudman, VI, West Sand Lake, N. Y.	310 Smith Hall
Polak, Frank Walter, VII, Lowell, Mass.	552 East Merrimack St.
†Prudenti, Joseph John, VII, Boston, Mass.	———
†‡Richard, Alfred Joseph, IV, Gardner, Mass.	201 Smith Hall
Rogers, Miriam Ruth, VI, Brooklyn, N. Y.	148 Riverside Street
†‡Roth, Irwin Jay, VII, Forest Hills, L. I., N. Y.	410 Smith Hall
Rottenberg, Ira Morvay, VI, New York, N. Y.	315 Smith Hall
*†‡Roux, Joseph Alexander, IV, Lowell, Mass.	30 Second Avenue
†‡Ruta, Stanley Anthony, V, Lowell, Mass.	10 May Street
Rutledge, Robert John, Jr., VI, Lowell, Mass.	Andover Street
Salevitz, Jack, III, Brooklyn, N. Y.	206 Smith Hall
*†Scagos, George Angelos, IV, Lowell, Mass.	19 Eighth Avenue
Schaaf, Donald John, IV, Fair Lawn, N. J.	31 Waverly Avenue
Scott, Wemyss, Ballentine, Jr., III, Rochester, N. H.	31 Waverly Avenue
†Shippee, Fred Boswell, IV, Danielson, Conn.	———
†‡Simmons, Robert Arthur, IV, Lowell, Mass.	397 Westford Street
†‡Singer, Eric, VI, New York, N. Y.	303 Smith Hall
Smoler, Avrum David, III, New York, N. Y.	77 Livingston Avenue
†Soumis, Francois, VI, Trois-Rivieres, Quebec,	313 Smith Hall
Stanton, Joseph Michael, Jr., VI, Tewksbury,	———
Stein, Harold Murray, VI, Lowell, Mass.	392 Chelmsford Street
Mass.	
Stone, Harold Richard, II, Woonsocket, R. I.	202 Smith Hall

Home Address	*College Address*
†SZCZEPANIK, HENRY MYRON, IV, Lowell, Mass.	165 Jewett Street
TESSLER, RAMON NORMAN, VII, Flushing, L. I., N. Y.	77 Livingston Avenue
THERRIEN, BERNARD EDMUND, IV, North Adams, Mass.	123 Riverside Street
THIBODEAU, WALTER NORMAN, IV, Bristol, Conn.	17 Sanborn Street
TOSONE, MARIO CARMEN, IV, Lawrence, Mass.	———
TRAVERSY, ADOLPHE ARTHUR, IV, Lowell, Mass.	103 Ennell Street
TRAVIS, LAZARUS, V, Brookline, Mass.	77 Livingston Avenue
‡VYAS, NATH MAL, II, Bikaner, India	206 Eames Hall
WASSERMAN, BERNARD, VI, Providence, R. I.	77 Livingston Avenue
WATT, CHARLES EDWARD, JR., VI, Chelmsford, Mass.	———
WINN, IRVING WOODMAN, JR., I, Lisbon Falls, Maine	114 Smith Hall
WISE, RALPH LEROY, IV, Lowell, Mass.	104 Fulton Street
‡WOO, KUO-CHUAN, I, Shanghai, China	5 White Street
WOOD, EUGENE JACKSON, JR., VI, Westford, Mass.	———
WU, CHUNG-SUNG, I, Kowloon, China	5 White Street
ZOGLIO, ELEANOR BARBARA, IV, Lawrence, Mass.	———

CLASS OF 1953

*‡ABRAHAMS, DAVID HILLEL, IV, Cliffside Park, N. J.	207 Eames Hall
ACKMAN, BARRY ALAN, III, Worcester, Mass.	310 Eames Hall
ADELL, ROBERT GODFREY, IV, Dorchester, Mass.	213 Eames Hall
ADLER, EDWARD JEROME, VI, New York, N. Y.	209 Eames Hall
ALBANI, ROBERT FRANCIS, VI, Hyde Park, Mass.	114 Eames Hall
ARNOLD, EDWARD, IV, Revere, Mass.	201 Eames Hall
ASHER, SURENDRA PURSHOTAM, I, West Bengal, India	105 Eames Hall
BAERWALD, EDGAR ARENDT, II, Santiago, Chile	401 Eames Hall
*‡BAGDON, HERBERT C., VI, Millburn, N. J.	202 Eames Hall
BARBER, HERBERT, VI, Bronx, N. Y.	310 Eames Hall
BARIL, RAYMOND LIONEL, IV, Lowell, Mass.	405 School Street
BARRETT, ROBERT WALLACE, V, Malden, Mass.	102 Eames Hall
BASTEK, JOSEPH LOUIS, IV, Lawrence, Mass.	———
BAXTER, GEORGE LYTTON, IV, Briarcliff, N. Y.	301 Eames Hall
BEALS, RICHARD ALLEN, VI, Springvale, Maine	212 Eames Hall
BEDER, ABNER MEYER, VI, Brooklyn, N. Y.	204 Eames Hall
BERGER, STANLEY, III, Bronx, N. Y.	214 Eames Hall
BINNS, ROBERT ALBERT, VI, Methuen, Mass.	———
BOATNER, DAVID NEWELL, VI, Brooklyn, N. Y.	203 Eames Hall
BOUTIETTE, JAMES PAUL, VII, Farnumsville, Mass.	104 Eames Hall
‡BOUTIN, FRANCIS, E., VI, Lawrence, Mass.	———

Home Address	*College Address*
Brandman, Monte Iva, VII, Brooklyn, N. Y.	203 Eames Hall
Brandt, Sanford, VII, Brooklyn, N. Y.	314 Eames Hall
‡Brody, Arnold Allan, VI, Brooklyn, N. Y.	320 Wilder Street
Brown, Ellwood Thomas, VI, Grafton, Mass.	109 Eames Hall
Burgess, Howard Charles, VI, Needham, Mass.	102 Eames Hall
Bussiere, William Raymond, V, Lewiston, Maine	212 Eames Hall
*Caless, Donald Huse, VI, Littleton, Mass.	———
Carolan, Francis James, IV, Lowell, Mass.	17 West Jenness Street
*Carroll, John Neil, V, Medford, Mass.	307 Eames Hall
Carty, William David, VI, Medford, Mass.	———
Cavallaro, Frank Anthony, IV, Lawrence, Mass.	———
Chace, Stephen Sheldon, IV, Westford, Mass.	———
Cobin, Howard Charles, IV, Brookline, Mass.	303 Eames Hall
*Conley, John Theodore, I, Warren, R. I.	315 Eames Hall
Copley, William Morgan, IV, Lowell, Mass.	179 Hildreth Street
Coughlin, Francis Richard, IV, Lowell, Mass.	442 Stevens Street
Cross, Robert James, VI, Westford, Mass.	———
Danza, Lawrence Benjamin, VI, Keyport, N. J.	408 Eames Hall
Darsch, Charles George, Jr., VI, North Plymouth, Mass.	301 Eames Hall
David, John Bernard, Jr., II, Dudley, Mass.	104 Eames Hall
DeFusco, William Joseph, VII, Lawrence, Mass.	———
Demas, Harry John, IV, Athens, Greece	402 Eames Hall
Denoncour, Maurice Paul, II, Franklin, N. H.	211 Eames Hall
‡Devereaux, John Lawrence, II, West Roxbury, Mass.	211 Eames Hall
Dielendick, Michael, II, Haverhill, Mass.	———
Dooley, William Eugene, IV, Lowell, Mass.	60 Willow Street
Dudgeon, Edward Kingston, IV, Sanford, Maine	411 Eames Hall
Duncan, James Henry, III, Monessen, Pa.	112 Eames Hall
Erving, Bjorn Roy, VI, New York, N. Y.	49 Crawford Street
*‡Essig, Abe Wilder, VI, New York, N. Y.	204 Eames Hall
Farrell, William Burton, III, Tewksbury, Mass.	———
‡Fisher, Lawrence Wallace, IV, Woburn, Mass.	
Fishman, Harvey Martin, IV, Brooklyn, N. Y.	311 Eames Hall
‡Flamand, Charles David, IV, Northbridge, Mass.	307 Eames Hall
‡Flannery, Joseph Patrick, IV, Lowell, Mass.	616 Stevens Street
Flood, Edward Robert, IV, Lowell, Mass.	89 Parkview Avenue
Freeman, Arnold Joel, VII, New York, N. Y.	205 Eames Hall

Home Address	*College Address*
Froehlich, Eugene Ferdinand, II, New York, N. Y.	309 Eames Hall
Gelbman, Bernard Richard, VI, Bronx, N. Y.	311 Eames Hall
Godfrey, Robert Steward, VI, Andover, Mass.	415 Eames Hall
Goldberg, Louis Stewart, VII, Brooklyn, N. Y.	413 Eames Hall
Goldsmith, Sidney Jonas, VII, Providence, R. I.	408 Eames Hall
Goodman, Leonard, V, Brooklyn, N. Y.	210 Eames Hall
Goon, Harry J., VI, Lowell, Mass.	370 Central Street
Gosselin, George Joseph, Jr., VI, Lawrence, Mass.	———
Goulart, Richard Francis, II, Cambridge, Mass.	113 Eames Hall
‡Greenberg, Robert Morris, IV, Dorchester, Mass.	407 Eames Hall
‡Grubman, Leonard, II, Brooklyn, N. Y.	111 Eames Hall
Guthrie, Joseph Andrew, III, North Andover, Mass.	———
*‡Hall, Richard King, IV, Lowell, Mass.	476 Westford Street
Haley, Lawrence Anthony, VI, Littleton, Mass.	———
Hamel, Gerald Roland, VI, Lowell, Mass.	173 A Street
‡Hamburger, Walter Julian, Jr., V, Dedham, Mass.	401 Eames Hall
Haralampopoulos, Harry Nicholas, IV, Nashua, N. H.	———
‡Harris, Paul David, VI, New York, N. Y.	213 Eames Hall
Harrahy, Donald James, VI, Worcester, Mass.	308 Eames Hall
Harty, William Francis, IV, Pawtucket, R. I.	108 Eames Hall
‡Hilliard, Everett Alvah, VI, Lowell, Mass.	45 Marshall Avenue
Hood, George Currier, Jr., VI, Lowell, Mass.	346 Boylston Street
Hudson, Ralph Edward, Jr., VI, Attleboro, Mass.	304 Eames Hall
*‡Iannazzi, Fred Domenic, IV, Lawrence, Mass.	
Jacobs, Horace Henry, VI, Mexico City, Mexico	409 Eames Hall
*‡Kamerman, Kenneth, VI, Brooklyn, N. Y.	201 Eames Hall
*‡Kaslow, John Francis, VI, Methuen, Mass.	———
*‡Kelley, Richard Jewett, IV, Lowell, Mass.	116 Nesmith Street
‡Khoury, Ernest Joseph, IV, Lawrence, Mass.	313 Eames Hall
King, Harold Francis, VI, Lowell, Mass.	109 Highland Avenue
Kupper, Alan Dee, II, Dorchester, Mass.	207 Eames Hall
Lajoie, Willard C. E., VI, Lowell, Mass.	9 White Street
Lawrence, George Campbell, II, Falmouth, Mass.	215 Eames Hall
*McHugh, Warren Paul, II, Chelmsford, Mass.	———
McKniff, Francis, II, Forge Village, Mass.	———
MacLellan, Neil, Jr., II, Larchmont, N. Y.	415 Eames Hall
McSheehy, Robert Wilder, II, Worcester, Mass.	113 Smith Hall

Home Address	College Address
Magnant, Alfred Joseph, VI, Rye, N. Y.	414 Eames Hall
‡Mann, Ellsworth George, Jr., VII, Ridgewood, N. J.	414 Eames Hall
Mann, Warren Eugene, VI, Troy, N. Y.	403 Eames Hall
Martin, John Owen, IV, Lowell, Mass.	299 Hildreth Street
Mavro, Othon John, II, Allston, Mass.	———
Merrill, Russell Winn, VI, Lowell, Mass.	2026 Middlesex Street
Messer, Jacob Elihu, IV, Ozone Park, N. Y.	202 Eames Hall
Mulcahy, John Richard, V, Brookline, Mass.	108 Eames Hall
*‡Mulcahy, Robert Edward, V, Arlington, Mass.	403 Eames Hall
Nachman, Steven Gunther, VI, Kew Gardens, N. Y.	314 Eames Hall
Nelligan, James Anthony, V, Lowell, Mass.	12 West Albert Street
Nordon, Franklin A., VI, Medford, Mass.	304 Eames Hall
Norman, William Arthur, VI, Hopedale, Mass.	113 Eames Hall
Nuzzolo, John Vincent, IV, Derby, Conn.	303 Eames Hall
O'Donnell, Roger Joseph, Jr., II, Dorchester, Mass.	111 Eames Hall
Ostrove, Donald Martin, I, Long Beach, N. Y.	306 Eames Hall
Oxer, Jerry, II, Bronx, N. Y.	302 Eames Hall
Paris, Irin Myron, III, Fairlawn, N. J.	306 Eames Hall
Pawlowski, Frederick Francis, VI, Lowell, Mass.	24 Jewett Street
Perez, Hernando D'Caro, VI, Colombia, S. A.	105 Eames Hall
Platnick, Leonard Howard, I, Brooklyn, N. Y.	211 Eames Hall
Polak, Walter Frank, V, Lowell, Mass.	552 East Merrimack St.
Profio, Robert Michael, IV, Lowell, Mass.	1878 Middlesex Street
‡Randall, Thomas Henry, IV, Chelmsford, Mass.	———
Reardon, William John, Jr., II, Framingham, Mass.	411 Eames Hall
Robbins, Walter Archibald, II, Minetto, N. Y.	102 South Loring Street
Robey, Robert Versal, VI, Chelmsford, Mass.	109 Eames Hall
Robinson, Bertram Robert, Jr., VII, Lowell, Mass.	17 Sutherland Street
Robinson, Donald Chaloner Balantyne, V, Marblehead, Mass.	313 Smith Hall
‡Rocha, Manuel Medeiros, VIII, Dedham, Mass.	313 Eames Hall
Saks, Morton Ira, I, Brooklyn, N. Y.	210 Eames Hall
Sanborn, Roger James, V, Lowell, Mass.	126 Seventh Avenue
Sanville, Ronald Joseph, II, Bradford, Mass.	———
Schain, Jerry Laurence, V, Bronx, N. Y.	404 Eames Hall
Scheier, Stanley Charles, VI, New York, N. Y.	312 Eames Hall
Schulman, Sidney Murray, V, Lowell, Mass.	75 Bellevue Street
Shantzis, Murray Mark, VI, New York, N. Y.	402 Eames Hall
*‡Sidelinker, Earl, V, Lowell, Mass.	1 Nelson Avenue
*‡Siegal, Donald, III, Lowell, Mass.	287 Stevens Street

Home Address	*College Address*
Skrekas, Helen Bonnie, IV, Dracut, Mass.	———
Smith, Donald Bishop, VI, Stow, Mass.	412 Eames Hall
*‡Smith, Robert Frank, III, Lawrence, Mass.	———
Smith, William Richard, IV, Tewksbury, Mass.	———
Stone, David Charles, VII, Brooklyn, N. Y.	208 Eames Hall
Swanson, Morris Harvey, VI, Westford, Mass.	———
Tanzer, Kenneth Elliott, IV, New York, N. Y.	208 Eames Hall
Tatlis, James Adolph, IV, Lawrence, Mass.	———
*‡Tewksbury, Charles Goward, VI, Lowell, Mass.	28 Windsor Street
‡Tingas, Arthur Stefanos, VI, Lowell, Mass.	601 Merrimack Street
Uffner, Jerome Howard, I, New York, N. Y.	205 Eames Hall
Uster, William Henry, VII, Rutherford, N. J.	103 Eames Hall
Vaillancourt, Paul Joseph, V, Lowell, Mass.	15 Gershom Avenue
VanDijk, Gerard Leo, V, Larchmont, N. Y.	110 Eames Hall
Valantlas, James Anastas, IV, Lowell, Mass.	99 Salem Street
Walsh, John Vincent, VI, Whitinsville, Mass.	409 Eames Hall
*Wark, Donald Thomas, IV, Westford, Mass.	———
Wattles, Benjamin, VI, Canton, Mass.	406 Eames Hall
Weber, Carl Alfred, VII, Los Angeles, Calif.	209 Eames Hall
Wiener, Melvin, III, Brooklyn, N. Y.	214 Eames Hall
Wilson, Douglas Newcomb, VI, Littleton, Mass.	———
Wuester, Erwin August, III, Riverdale, N. J.	406 Eames Hall

SERIES 54. NO. 1.
CURRICULUM BULLETIN

August, 1950

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

1950-1951

Entered August 26, 1902, at Lowell, Mass., as second-class matter
under act of Congress of July 16, 1894

Textile and Colonial Avenue

DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document Approved by George J. Cronin, State Purchasing Agent

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OF THE LOWELL TEXTILE INSTITUTE

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CALENDAR — 1950

September 21, 26 and 28, 7–8:30 P.M.	Registration
October 3, 7–8:30 P.M.	Registration
October 9, Monday	Opening of Evening School
October 12, Thursday	Columbus Day — Holiday
November 22 and 23, Wednesday and Thursday	Thanksgiving Recess
December 18, Monday	Christmas Recess begins

1951

January 2, Tuesday	Classes resume
February 22, Thursday	Washington's Birthday — Holiday
March 8, Thursday	Evening classes end

GENERAL INFORMATION

Entrance Requirements

Entrance requirements vary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Lowell Evening Textile School, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Textile School, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering on the evenings set aside for that purpose.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules).

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

A registration fee of one dollar is required of *all* students, in addition to tuition and other charges.

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell. However, registration may be completed prior to filing this certificate with the office.

To non-residents the tuition fees are as follows:

One evening per week courses	$ 5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course must make a laboratory deposit of $10. Those electing Machine Shop Practice must make a laboratory deposit of $5. This is to cover supplies and breakage and any unexpended balance at the end of the year will be returned to the student. These laboratory deposit provisions apply to both residents and non-residents of Lowell.

All fees and deposits are payable in advance.

Refunds

Students dropping out of a course anytime before the end of the first ten weeks may obtain a refund of one-half their tuition. Unused portions of laboratory deposits will be refunded at the end of the course. No refund of tuition will be made after the first ten weeks. The registration fee of one dollar will not be returned in any case unless the course is cancelled.

Late Registration

No registration for any course will be accepted after the first three weeks of classes in that course.

Veterans

All Lowell Evening Textile School courses are approved for study under the G. I. Bill of Rights. Veterans should secure a certificate of eligibility from the Veterans' Administration before registering. Books and supplies can not be obtained without it. A letter from the Veterans' Administration showing application for a certificate has been made will be accepted for temporary admission to classes but must be followed by a certificate of eligibility or tuition charges will be made.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6.45 to 8.15 P.M.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

Inclement Weather

Due to difficulties in notifying in time students and instructors who reside at a distance, evening school will not be cancelled for reasons of weather at any time.

Attendance

Students must attend 70% of all classes held in a course in order to receive credit for the course. Four unexplained absences in a row will result in the student being automatically dropped from the rolls.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing of courses on following pages).

The diploma of the Lowell Evening Textile School will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for five or six years. At present diploma courses are being offered in Analytical Chemistry (six years), Textile Chemistry and Dyeing (five years), Textile Chemistry and Testing (five years), Cotton Manufacturing (six years), Woolen Manufacturing (five years) and Worsted Manufacturing (six years).

The diploma courses were initiated in 1947 and, as yet, their content is tentative and subject to change. The Institute expressly reserves the right to alter or change them in scope and content as it deems advisable. In general, however, they should not differ materially from the programs shown.

All students working towards a diploma should contact the director of evening school as soon as possible to work out a schedule of courses suitable to their objective.

COTTON DEPARTMENT

Staff

Prof. Gilbert R. Merrill, B.T.E., in charge of department
Assoc. Prof. Nathaniel E. Jones
Asst. Prof. John A. Goodwin, B.T.E.
Mr. Clarence J. Pope, B.S.
Mr. Ferrell G. Kent

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Cotton Yarns	101-A	X		X		None
Cotton Yarns	101-B		X		X	101-A
Cotton Yarns	101-C	X		X		101-B
Knitting	113		X		X	None

Description of the Above Courses

101-A *Cotton Yarns.* First year of cotton yarn manufacture. Topics covered include: properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, and carding. Lecture and laboratory.

101-B *Cotton Yarns.* Second year of cotton yarn manufacture. Topics covered include: combing, drawing, regular and long draft roving. Lecture and laboratory.

101-C *Cotton Yarns.* Third year of cotton yarn manufacture. Topics covered include: spinning, spooling, winding and twisting. Lecture and laboratory.

113 *Knitting.* A general course in the manufacture of knitted fabrics and garments. It includes yarns and yarn sizing.

Certificates

The certificate of the school will be awarded for completion of the three-year ourse in cotton yarns, 101-A, 101-B and 101-C. A certificate will also be awarded or the completion of 113.

Diploma in Cotton Manufacturing

A diploma in cotton manufacturing will be awarded to those completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work towards an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to schedule in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

Courses required for a diploma include three years of cotton yarn manufacture, mechanism, two years of cotton design, two years of warp preparation and weaving, cotton dyeing and finishing, textile testing, marketing and knitting.

While the work load in individual years will vary, a student could expect to complete this program in six years if he attends an average of three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

The minimum requirement for the diploma in Cotton Manufacturing is a total of 720 classroom hours or an average of three evenings per week for six years.

The following courses must be taken:

Cotton Yarns 101-A, 101-B and 101-C; Weave Formations 301-A; Yarn Calculations 301-B; Cotton Design 327 and 328; Power Weaving 332; Cotton Finishing Survey 718; Textile Testing (a special one evening per week course not yet listed).

The above courses total 520 classroom hours. The remaining 200 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Power Weaving 333, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630, and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

WOOLEN AND WORSTED DEPARTMENT

Staff

Prof. James H. Kennedy, Jr., B.T.E., M.S., in charge of department
Asst. Prof. Henry L. Pero, B.T.E.
Asst. Prof. J. Frederic Burtt, B.T.E.
Asst. Prof. Henry E. Thomas, B.T.E.
Mr. Michael J. Koroskys
Mr. James T. Simpson

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Technology of Fibers and Yarns	202			X		None
Woolen Yarns	203	X	X			601
Top Making	204	X				601
Bradford Yarns	205			X		601
French Yarns	206	X	X			601
Textile Mechanism & Calculations	601				X	None

Description of Above Courses

202 *Technology of Fibers and Yarns.* Types of sheep and wool. Wool buying, selling, grading, sorting, scouring, stock carbonizing. Mohair, alpaca, camel hair, etc. Theory and principles of yarn making by all systems. Roller drawing, spindle drawing, porcupine. Mostly lectures, some laboratory demonstrations.

203 *Woolen Yarns.* Fiber blending, oiling, picking, woolen carding, mule and frame spinning, twisting, Reprocessed and reused fiber preparation from rags to fiber ready for carding. Mostly lectures. some laboratory demonstrations.

204 *Top Making.* Worsted carding, backwashing, open gilling, Noble combing. Specifications and analyses of standard tops, Warner Swasey Pin Drafter, Pacific Converter, Perlok System. Mostly lectures, some laboratory demonstrations.

205 *Bradford Yarns.* Worsted drawing, spinning, and twisting on English system machinery. The newer short-cut systems using the Warner Swasey Pin Drafter. Mostly lectures, some laboratory demonstrations.

206 *French Yarns.* French combing, intersecting gilling, blending, French system worsted drawing, spinning, and twisting. Mostly lectures, some laboratory demonstration.

601 *Textile Mechanism and Calculation.* A short course covering the necessary mechanism, physics and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers, cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is designed to be taken simultaneously with the courses for which it is a prerequisite.

Certificates

The certificate of the school will be awarded for the following group of courses

Woolen Yarn Certificate—	For completion of courses 601, 202, 203.
Top Making Certificate—	For completion of courses 601, 202, 204.
Bradford Worsted Certificate—	For completion of courses 601, 202, 204, 205
French Worsted Certificate—	For completion of courses 601, 202, 204, 206

Diplomas

A diploma in woolen or worsted manufacture will be awarded to students completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work toward an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to take in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

These courses will give the necessary background for the operation of a woolen or worsted mill and are designed for the student who wishes to prepare himself for the higher supervisory and executive positions.

The minimum requirement for the diploma in either woolen or worsted manufacture is a total of 720 classroom hours or an average of three evenings per week for six years.

For a diploma in woolen manufacture the following courses must be taken: Technology of Fibers and Yarns 202, Woolen Yarns 203, Textile Mechanism and Calculations 601, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Finishing 710, and Textile Testing (a special one evening per week course not yet listed in the bulletin).

The above courses total 520 classroom hours. The remaining 200 hours that are required may be elected by the student from the two groups of subjects listed after the requirements for the diploma in worsted manufacture. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

For a diploma in worsted manufacture the following courses are required: Technology of Fibers and Yarns 202, Top Making 204, Textile Mechanism and Calculations 601, Bradford Yarns 205, French Yarns 206, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Finishing 710 and Textile Testing (a special one evening per week course not yet listed in the bulletin).

The above courses total 600 classroom hours. The remaining 120 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630 and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

TEXTILE DESIGN AND WEAVING DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Assoc. Prof. Russell M. Fox
Asst. Prof. Martin J. Hoellrich
Asst. Prof. John L. Merrill, B.T.E.
Asst. Prof. Edward L. Golec
Mr. Heman Hunter
Mrs. Lucy R. Weinbeck, B.T.E.
Mr. Jordan Levin, B.S.

EVENINGS

SUBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
Weave Formations (First 10 weeks only)	301-A			X		None
Yarn Calculations (First 10 weeks only)	301-B	X				None
Cotton Design (Second 10 weeks only)	327	X		X		301-A, 301-B
Cotton Design	328		X		X	327
Woolen Design (Second 10 weeks only)	329	X		X		301-A, 301-B
Woolen & Worsted Design	330	X		X		329
Synthetic Design (Second 10 weeks only)	325-A		X		X	327
Synthetic Design	325-B		X		X	325-A
Fabric Identification (Second 10 weeks only)	331		X		X	301-A
Power Weaving (First 10 weeks only)	332		X		X	None
Power Weaving‡	333	X		X		332
Loom Fixing‡	324		X		X	333

Loom Fixing may be taken without 333 provided sufficient work has been done by the student in industria weaving. 333 may be taken without 332 under similar conditions.

Description of the Above Courses

301-A *Weave Formations.* This subject covers weaves of all types from the plain weave through fancy and figured weaves. Harness draft and chain are worked out for each weave.

301-B *Yarn Calculations.* Yarn counts for all systems, including ply and fancy yarns, are covered.

327 *Cotton Design.* Cotton cloth analysis and design are studied, beginning with plain fabrics and leading into the more fancy dobbies.

328 *Cotton Design.* The design of more elaborate cotton fabrics is taken up such as filling backed, warp backed, ply, velvet, leno, etc.

329 *Woolen Design.* Cloth analysis and design covering blankets, bath robing, filling reversibles, extra warp and filling backs, figured effects, double cloths and plaid back.

330 *Woolen and Worsted Design.* This subject includes the more complicated fabrics some of which are chinchilla, melton, kersey as well as suitings. Costs for woolen and worsted fabrics are also covered.

325-A *Synthetic Design.* Cloth analysis and design of synthetic fabrics, including both filament and spun yarns.

325-B *Synthetic Design.* A continuation of 325-A covering the more fancy and complicated types of synthetics.

331 *Fabric Identification.* An elementary course in fabrics for those not specializing in industrial work, such as retail clerks, home economics students, etc.

332 *Power Weaving.* Warp preparation in all systems is covered as well as the Draper and Stafford automatic looms. Lecture and laboratory.

333 *Power Weaving.* More complicated looms are studied including dobby and Crompton & Knowles looms. Primarily woolen and worsted weaving. Lecture and laboratory.

324 *Loom Fixing.* The timing of all different motions in the loom and remedies for improper settings are covered. Box and harness chain planning and building are included. Lecture and laboratory.

Certificates

The cotton design certificate will be awarded for completion of 301-A, 301-B, 327, and 328.

The woolen and worsted design certificate will be awarded for completion of 301-A, 301-B, 329 and 330.

The synthetic design certificate will be awarded for the completion of 301-A, 301-B, 325-A and 325-B.

The loom fixing certificate will be awarded for the completion of 324.

The weaving certificate will be awarded for the completion of 333.

Diplomas

No diploma in design and weaving is offered as yet, but plans are under way for such. When and if a diploma is offered, the above certificates will count towards it.

ART DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department

Mr. Elbert G. Bowring
Mrs. Helen Chace
Miss Antoinette Nault
Mr. John F. Vaughan
Mrs. Mary S. Kiernan
Miss Arlene Redmond
Mr. E. Stuart Dickison
Miss Electra Vlahos

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Freehand Drawing	313-A					
Section I		X		X		None
Section II			X		X	None
Pastel Drawing	334		X		X	313-A
Life Drawing	313-B	X		X		313-A
Silk Screen Printing	326		X		X	None
Show Card Design	314-A	X		X		None
Costume Design	335		X		X	None

Description of the Above Courses

313-A *Freehand Drawing.* Drawing in charcoal from casts and group arrangements of still life. Both sections cover the same material.

334 *Pastel Drawing.* Drawing in pastel from still life group arrangements.

313-B *Life Drawing.* Drawing from the live model in charcoal or in pastel. Individual and class instruction in anatomy.

326 *Silk Screen Printing.* This course covers the stencilling and printing on textiles and paper with the silk screen.

314-A *Show Card Design.* Pencil drawing of the alphabet and simple layouts of card signs executed in tempera paints.

335 *Costume Design.* How to alter the commercial garment pattern to suit the requirements of any figure.

Certificates

A one-year certificate will be awarded for the completion of any of the above courses.

The three-year art certificate previously awarded will still be available for those who commenced their work prior to 1949–50.

CHEMISTRY DEPARTMENT

Staff

Prof. Elmer E. Fickett, B.S., in charge of department

Assoc. Prof. John H. Skinkle, S.B., M.S.
Assoc. Prof. William G. Chace, Ph.B., M.S.
Asst. Prof. Charles L. Daley, B.T.C.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Prof. John J. McDonald, B.T.C.
Asst. Prof. Ernest P. James, B.T.C., M.S.
Mr. Thomas F. Kelley, Jr., B.S.
Mr. Vasilis Lavrakas, B.S., M.S.
Mr. Walter J. Lisien, B.T.C.
Mr. Joseph B. Masaschi, B.T.C., M.S.
Mr. Ray E. MacAusland
Mr. Herman Brown, B.S.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
General Chemistry	411-A		X	X	X	None
General Chemistry	411-B	X		X	X	411-A
Qualitative Analysis & Stoichiometry	411-C	X		X	X	411-B
Quantitative Analysis & Stoichiometry	413-A	X	X		X	411-C
Quantitative Analysis & Stoichiometry	413-B	X	X		X	413-A
Quantitative Analysis & Stoichiometry	413-C	X	X		X	413-B
Textile Chemistry & Dyeing	412-A	X	X		X	411-B
Textile Chemistry & Dyeing	412-B	X	X		X	412-A
Textile Chemistry & Dyeing	412-C	X	X		X	412-B
Dye Testing	416-A	X	X		X	411-B
Textile Testing & Microscopy	416-B	X		X	X	416-A
Textile Testing & Microscopy	416-C	X		X	X	416-B
Organic Chemistry (First 10 weeks only)	417	X				411-B
Physical Chemistry*	421		X		X	413-C
Physical Chemistry Laboratory	421-A			X		421
Chemical Engineering	431	X				See course description

*Not offered in 1950-51.

Description of the Above Courses

411-A *General Chemistry.* For those with no previous knowledge of chemistry. This course covers the basic principles of inorganic chemistry including the fundamental chemical laws; the preparation, properties, and uses of metals, non-metals and related compounds; and simple chemical calculations. Lectures and laboratory. Two lectures, 7–9:30 P.M., one laboratory, 6:30–9:30 p.m., per week.

411-B *General Chemistry.* A course in elementary chemistry of college grade, open to those who have passed 411-A or a satisfactory course in high school chemistry. Emphasis is on the laws and theories of inorganic chemistry. Text—General Chemistry by Timin. Two lectures, 7–9:30 P.M., one laboratory, 6:30–9:30 P.M., per week.

411-C *Qualitative Analysis and Stoichiometry.* A basic course in the systematic analysis of inorganic compounds, carried out by the student in the lab. Chemical calculations and the balancing of chemical equations are covered in the stoichiometry portion of the course. One lecture, 7–9:30 P.M., two laboratories, 6:30–9:30 P.M., per week.

413-A, 413-B, 413-C *Quantitative Analysis and Stoichiometry.* The first two years of this three-year course cover the underlying principles of gravimetric and volumetric analysis, with sufficient laboratory work to enable the student to become proficient in performing routine analysis. The third year consists in the analysis of water, soap, oils, coal and other materials of interest to the textile chemist. One lecture, 7–9 P.M.; two laboratories, 6:30–9:30 P.M., per week.

412-A, 412-B, 412-C *Textile Chemistry and Dyeing.* This course covers three years work of lectures and laboratory in the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of the fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic, and union materials. Organic chemistry and the technology of fibers are covered in the first year's lecture. One lecture, 7–9 P.M.; two laboratories, 7–9 P.M., per week.

416-A *Dye Testing.* This course covers the necessary principles of dyeing and concentrates on the testing of dyes for fastness to light, washing, perspiration, etc., by modern laboratory testing technique. Lecture and laboratory. 7–9 P.M.

416-B, 416-C *Textile Testing and Microscopy.* A two-year course covering the fundamentals of textile testing whereby the various physical, chemical, and optical methods are integrated into a unified program. Some of the topics covered include: regain, yarn numbers, twist, bursting strength, tear resistance, strength and elongation, yarn and seam slippage resistance, abrasion testing, permeability, water repellent and water proofness, fiber mixtures, longitudinal and cross-sectional mounts of various fibers, and the operation of various optical instruments. Lecture and laboratory. 7–9 P.M.

417 *Organic Chemistry.* A study of the important classes of carbon compounds and the fundamental theories of organic chemistry. Lecture only. 7–9 P.M.

421 *Physical Chemistry.* An elementary course in physical chemistry designed for the man in the laboratory or in industry. It includes a discussion of properties of gases, liquids, solids and solutions, chemical equilibrium, phase equilibrium, thermochemistry, electrochemistry and other topics according to the need of the students. Text used is "Physical Chemistry" by Bucher. This course is given alternate years with Physical Chemistry Laboratory. Two lectures per week, 7–9 P.M.

421-A *Physical Chemistry Laboratory.* Practice in the use of the methods and apparatus of physical chemistry. Includes measurement of vapor pressure, viscosity, surface tension, heat of combustion and reaction, pH by several methods and conductivity. Methods of determining molecular weight, distribution constant and calibration of apparatus are also included. Manual used is "Physico-Chemical Experiments" by Livingston. One laboratory per week, 6:30–9:30 P.M.

431 *Chemical Engineering.* Some important operations in chemical manufacturing, e. g., sulfuric acid production, will be surveyed from the standpoint of application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Flow of fluids, heat transfer, diffusional processes with particular reference to humidification, dehumidification and drying will be covered from the standpoint of the textile, leather and paper trades. The unit operations of distillation, filtration, absorption and extraction will also be studied.

This course is a graduate level course and carries credit for the M.S. degree at Lowell Textile Institute. Prerequisites are differential and integral calculus and two to three years of college chemistry including physical chemistry.

Diplomas

A diploma in Analytical Chemistry will be awarded for the successful completion of courses 411-A, 411-B, 411-C, 413-A, 413-B, and 413-C. This normally takes six years of three evenings per week.

A diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of courses 411-A, 411-B, 412-A, 412-B, and 412-C. This normally takes five years of three evenings per week.

A diploma in Physical and Chemical Textile Testing will be awarded for the successful completion of 411-A, 411-B, 416-A, 416-B, 416-C, and 417. This requires five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses and will be accepted for day school credit towards the B.S. degree of the Lowell Textile Institute.

Certificate

For those wishing only a general knowledge of chemical fundamentals, a certificate will be issued for the completion of General Chemistry 411-A and 411-B.

A certificate is also awarded for both Physical Chemistry 421 and Physical Chemistry 421-A.

ENGLISH DEPARTMENT

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Assoc. Prof. James G. Dow, A.B.
Mr. Louis W. Stearns, B.S., M.A.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
English composition	511-A	X				None
English composition	511-B				X	511-A
Appreciation of Literature	512		X			None

Description of the Above Courses

511-A *English Composition.* The fundamentals of composition including remedial English, grammar and rhetoric.

511-B *English Composition.* A course in how to write clearly and correctly. An intensive study is made of narration, description, exposition, argumentation and the art of letter writing.

512 *Appreciation of Literature.* A course for those wishing to enlarge their cultural background and study the principles of literary appreciation and criticism. Prose and poetry will be treated analytically with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative and the philosophical.

Certificates

The certificate of the school will be awarded for the successful completion of 511-A and 511-B.

BUSINESS AND INDUSTRIAL MANAGEMENT

Staff

Prof. Charles F. Edlund, S.B., Ed.M., in charge of department
Mr. Francis Maria, M.A.
Mr. Armand J. Sorbo
Mr. Richard W. Ivers, B.A.
Mr. Arthur Erickson
Mr. William T. Fleming
Mr. Edward W. Leary

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Foremanship	653	X		X		None
Industrial Relations	655	X		X		None
Principles of Salesmanship	656		X		X	None
Principles of Advertising	657		X		X	None

Description of the Above Courses

653 *Foremanship.* A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

655 *Industrial Relations.* A basic course in the underlying principles of harmonious relations between employer and employee. Some of the topics covered include: company policies and the foreman, employee morale, grievances, wages, training, collective bargaining, unions, government regulations, arbitration, etc.

656 *Principles of Salesmanship.* The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

657 *Principles of Advertising.* The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

Certificates

A certificate will be awarded for the completion of any one of the above six courses.

ENGINEERING DEPARTMENT

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T.I., in charge of department
Prof. A. Edwin Wells, B.T.E., Ed.M.
Assoc. Prof. Harry C. Brown, S.B.
Assoc. Prof. Milton Hindle, B.T.E.
Asst. Prof. Horton Brown, B.S.
Asst. Prof. Henry E. Thomas, B.T.E.
Asst. Prof. Maurice E. Gelinas, S.B., A.M.
Asst. Prof. Andrew A. Ouellette, Sc.B.
Mr. Philip A. Hall, B.S.
Mr. Adolph Katz, B.S., M.S.
Mr. Robert K. Devejian, B.S.
Mr. Robert M. Kennedy, B.T.E.
Mr. Isaac Chase, Jr., B.S.
Mr. James W. Bell
Mr. Edward N. Sabbagh, B.S.
Mr. J. Arthur Ainsworth, B.S., M.S.
Mr. Albert L. Carpentier, B.S.
Mr. Elliot F. Humiston, Jr., S.B.
Mr. Ernest W. Lareau, B.S.

Mathematics and Engineering Subjects

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Mathematics	620-A	X		X		None
Mathematics	620-B		X		X	620-A
Mathematics	645	X		X		None
Physics	647		X		X	None
Mechanical Drawing	613-A	X		X		None
Mechanical Drawing	613-B		X		X	613-A
Mechanical Drawing	613-C		X		X	613-B
Architectural Drawing	613-D		X		X	613-A
Architectural Drawing	613-E		X		X	613-D
Blue Print Reading	638		X		X	None
Machine Shop Practice	614-A			X	X	None
Machine Shop Practice	614-B	X	X			614-A
Strength of Materials	621		X		X	None
Steam	622	X		X		None
Mechanism	630		X		X	None
Diesel Engines	632		X		X	None
Air Conditioning	634	X		X		None
Textile Testing	639	X		X		None
Quality Control in manufacturing	646		X		X	See description
Calculus	648		X		X	Algebra and Trig.
Charts and Graphs	649	X		X		None

Description of the Above Courses

620-A *Mathematics.* Algebra including addition, multiplication, subtraction, division, factoring and fractions.

620-B *Mathematics.* A continuation of 620-A. Some of the topics treated are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigonometry.

645 *Mathematics.* An accelerated course in algebra for those satisfying the instructor as to their ability to pursue it. It covers algebra from the beginning to beyond quadratics.

647 *Physics.* An elementary course in physics on the high school level, designed primarily for those lacking sufficient high school credits to work towards a diploma. Lecture and demonstration.

613-A *Mechanical Drawing.* The fundamentals of drawing. Use of instruments, geometric construction, lettering, orthographic projection, auxiliary views, sectional views and dimensioning.

613-B *Mechanical Drawing.* Second year for those whose interest is primarily in machine drawing. Engineering sketching, screw threads and fasteners, intersections and developments of surfaces, pictorial drawing.

613-C *Mechanical Drawing.* Third year. Sheet metal drawing, detail and assembly drawing, blueprinting from pencil and ink originals. Computation of areas, volumes and weights.

613-D *Architectural Drawing.* A continuation of 613-A for those whose main interest is in architectural drawing. The course will revolve about the design of a small house and will include a plot plan, floor plans, elevations, sections and architectural details.

613-E *Architectural Drawing.* Third year. The set of house plans begun in 613-D will be completed with drawings of heating, plumbing and electrical systems in orthographic and isometric styles. Cost estimates and a perspective of the house will complete the course.

638 *Blue Print Reading.* A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc., in order to read and understand blue prints.

614-A, 614-B *Machine Shop Practice.* A two-year course in metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, heat treatment, forging, use of special tools, etc.

621 *Strength of Materials.* A basic course in strength of materials covering such topics as tension, compression, shear,ocast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, b iler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

622 *Steam.* Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

630 *Mechanism.* A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

632 *Diesel Engines.* An elementary istudy of diesel engines, their operation, and maintenance. Topics covered]include types of diesels, fuel oils, fuel injection systems, combustion, coo ng systems, application, maintenance, etc. Lectures and assignments.

634 *Air Conditioning.* A course in the principles of air conditioning covering the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

639 *Textile Testing.* A study of the methods used in the determination of the physical properties of textiles and the interpretation of test data. The topics covered include a consideration of textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, tearing strength, thickness, bursting strength, crimp, twist, regain. etc. Lectures and laboratory.

646 *Quality Control in Manufacturing.* This course deals with the quality problem in manufacturing and approaches it through the use of statistical quality control. How to determine the true accuracy of a machine or process, how to distinguish between normal and abnormal variations in any process and how to use small sample plans for inspection are examples of topics covered. Prerequisite: Approval of the instructor. Normally requires two years of college or industrial experience. Statistics is not required. Limited to 25.

648 *Calculus.* The fundamental principles of differential and integral calculus. The first half covers differential calculus with the necessary analytical geometry and the second half covers integral calculus. This course is a college credit course and is accepted for credit toward the B.S. degree of Lowell Textile Institute. Only students with a good background and ability in mathematics should attempt this course.

649 *Charts and Graphs.* This course covers instruction and practice in the construction and drawing of charts, graphs, sketches, posters, etc., made with ordinary office equipment on graph paper, ditto master sheets, stencils, etc.

Certificates

The certificate of the school is awarded for the completion of the following courses or groups of courses described above: 620-A and 620-B; 645; 647; 613-A, 613-B, 613-C; 613-A, 613-D, 613-E; 638; 614-A and 614-B; 621; 622; 630; 632; 634; 639; 646; 648; and 649.

ELECTRICITY

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Electrical Circuits	644	X		X		Algebra
D. C. Machinery	636-A		X		X	644
A. C. Machinery	636-B		X		X	644
Fundamentals of Electronics	640		X		X	644
Industrial Electronics	641			X	X	640
Principles of Radio	642	X		X		640

Description of the Above Courses

644 *Electrical Circuits.* A basic course in direct and alternating current circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

636-A *D. C. Machinery.* The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D. C. equipment.

636-B *A. C. Machinery.* Topics include application of instruments to A. C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

640 *The Fundamentals of Electronics.* Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

641 *Industrial Electronics.* The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

642 *Principles of Radio.* Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

Certificate

The certificate of the school will be awarded for the successful completion of any of the above six courses. Those who commenced work on the old three-year certificate prior to this year will still be awarded three-year certificates in Electrical Machinery (644, 636-A and 636-B), Industrial Electronics (644, 640 and 641) and Radio (644, 640 and 642).

FINISHING DEPARTMENT

Staff

Assoc. Prof. Winford S. Nowell, B.M.E.
Asst. Prof. John J. McDonald, B.T.C.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Woolen & Worsted Finishing	710	X		X		None
Cotton & Synthetic Finishing	711		X		X	None
Cotton Finishing Survey	718			X		None

Description of Above Courses

710 The finishing of both woolen and worsted cloths. Some of the topics covered are burling, mending, fulling, washing, speck dyeing, carbonizing, gigging, napping, steaming, brushing, shearing and pressing. Lectures and some laboratory demonstration.

711 The finishing of cotton and synthetic fabrics. Some of the topics covered are inspecting, trimming, shearing, singeing, washing, napping, mangles, starching, dryers, stretchers, callenders, folding and marking. Lectures and some laboratory demonstration.

718 A summary of the important features of Course 711, designed for diploma students in cotton yarn manufacture and others who would like a background in the finishing process.

Certificates

The certificate of the school will be awarded for the successful completion of either Course 710 or 711.

DEPARTMENT OF PAPER ENGINEERING

Staff

Prof. Geoffrey Broughton, B.Sc., M.Sc., S.M., Sc.D., in charge of department
Mr. Alfred K. Hobbs

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Paper Technology	801		X		X	None

Description of the Above Course

801 *Paper Technology.* This course is divided into four parts, Coarse Papers, Fine Papers, Paper Testing and Printing Processes as Applied to Paper, anyone of which may be taken independently. The first ten weeks of the course covers the basic principles of paper manufacture for both coarse and fine papers. Coarse papers are covered on Tuesday evenings and fine papers on Thursday evenings. For the first few basic lectures the two groups are combined, however.

The second ten weeks covers paper testing, on Tuesday evenings, and the printing processes as applied to paper on Thursday evenings.

Certificate

The certificate of the school will be awarded for the successful completion of all four parts of Paper Technology 801.

Diploma

It is planned to offer a diploma course in paper technology in the near future. The first four years of the required six years work will be in basic chemistry and will consist of General Chemistry 411-A and 411-B, Qualitative Analysis 411-C and a special one-year course in Quantitative Analysis; the fifth year will cover the principles of paper manufacture and the sixth year will be a laboratory course in paper testing and technology. Those wishing to start on the chemical portion of this diploma course now, will receive full credit towards the diploma for the above chemical courses.

DEPARTMENT OF LEATHER ENGINEERING

Staff

Prof. Albert E. Chouinard, B.S., M.S., Ph.D., in charge of department
Mr. Alfred H. Mueller

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thurs.*	*PREREQUISITE*
Technology of Leather	418		X		X	Chemistry

Description of the Above Course

418 *Technology of Leather.* An elementary course covering the preparation of leather of various types and finishes. The chemistry and technology of various tannery processes are covered so as to be understandable to a student with a fair knowledge of chemistry. Lectures only. 7–9 P.M.

Diploma

It is planned to offer a six-year diploma course in Leather Engineering in the near future. The first three to four years will consist of basic chemistry courses. Students interested in such a program may start with General Chemistry 411-A and 411-B and Qualitative Analysis 411-C. These courses will definitely count towards the leather diploma.

Series 54, No. 2

November, 1950

BULLETIN

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1950

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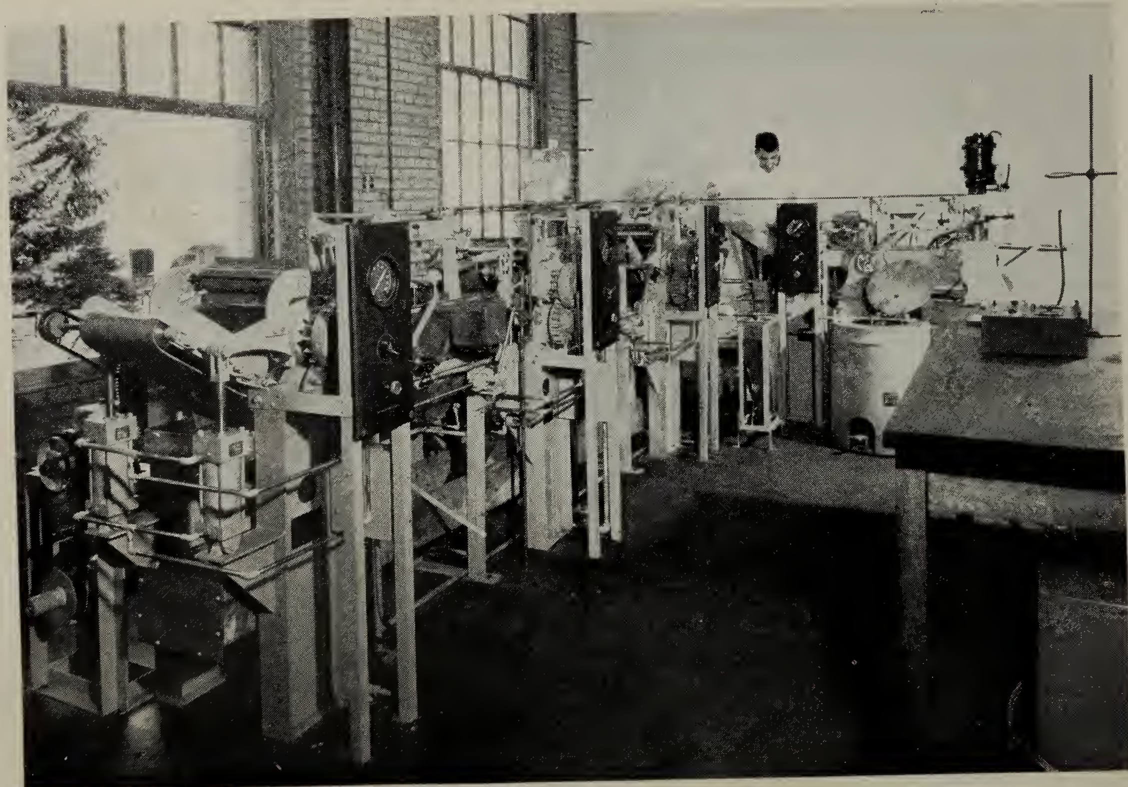


The Laboratory Model Wool Scouring Machine

AN EXPERIMENTAL WOOL SCOURING MACHINE

by

Harold H. Webber*

INTRODUCTION

In the pursuance of an investigation of the stream pollutional contributions of wool scouring liquors, the evident need for wool scouring waste liquors of known origins was recognized. The imperative condition for the intelligent prosecution of any research is that an effective control be exercised over the variables influencing the phenomena under study. This condition can only be realized if the research workers have within their operating control the process which produces the waste to be studied. This fact became apparent during the early stages of the development of the research program, when samples of wool scouring waste liquors were procured from several of the commercial scouring operations in the vicinity of this laboratory. Variations were readily recognized which quantitatively exceeded differences of several hundred per cent and qualitatively ranged over a wide diversity of constituents.

The influences which affect these wide variations reside in (1) the nature of the raw wool introduced into the washing machines, this in turn being a function of the environmental and genetic origins of the raw wool; (2) the chemical conditions, e.g., detergent concentration, alkali concentration, water to wool ratios, etc., which are imposed upon the washing process by the introduction of materials selected to enhance the removal of "impurities"; and (3) the physical conditions maintained in the scouring bowl, in part under the control of the operator, e.g., temperature, squeeze-roll pressures, contact time per bowl, rate of thru-put, etc.

The proper balance of these diverse influences on the conditions of the wool scouring process has been achieved successfully for the most part in most currently operating wool mills. However, the conditions obtained are dictated by the requirements for the removal of the undesirable constituents of raw wool at the most economic cost and are not selected primarily with a view to the exigencies of subsequent by-product recovery and waste treatment. This latter consideration is now imposed upon the attention of all wool scourers and the recognition of this fact has dictated the objectives of this research.

In order, therefore, to provide this research effort with scouring wastes produced under controlled conditions, a laboratory scouring machine was designed and constructed. Recognition of the need for simulating as accurately as possible the mean conditions observed in the industry in order to make the results more directly applicable and acceptable, the plan was first discussed in detail with commercial wool scouring interests. Many valuable suggestions resulted which influenced the planning so as to enable operation of the equipment over wide limits. These limits in all cases have been established so that the scouring process and the waste effluents resulting therefrom can be studied over a wide range of conditions.

DESCRIPTION

In the economy of cost of construction and operation of the experimental scouring machine, a size scale was selected which would accomplish the motives of the research and fall within the limits of the research budget. This size was determined by consideration of wool sample size, quantity of effluent produced, chemical costs, ease of operation, and installation of the necessary controls, e.g., pneumatic loading. Stainless steel type 316(16-11) was selected for all parts which would come in contact with the liquors to enable the study to include a wide range of pH values and corrosive chemicals.

*Director of Experiment Station, Lowell Textile Institute

Figure 1 provides an engineering drawing of the apparatus described below.

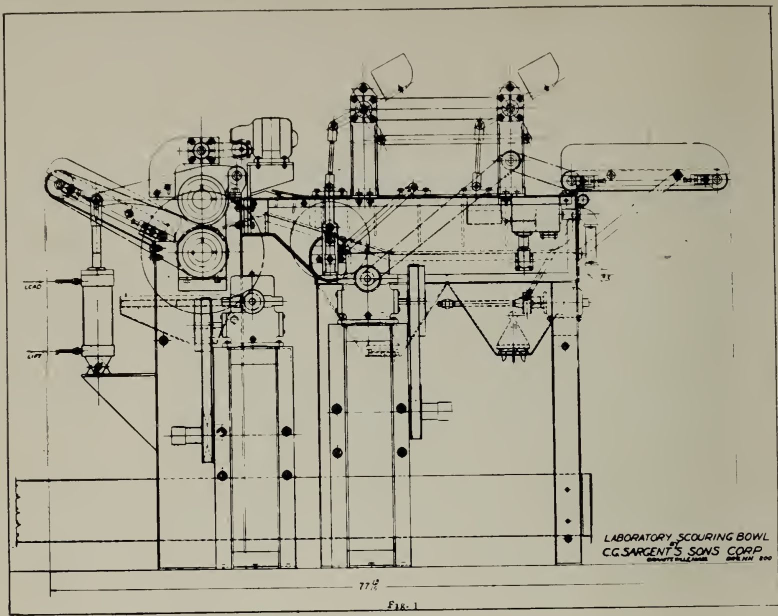


FIGURE 1

A. *Scouring Bowl*

The inside dimensions of each of the four bowls in the train are 36 inches in length and 10 inches in width with two 60° extra-deep hoppers per bowl to allow for adequate settling capacity. The holding liquor capacity per bowl is approximately 16 gals.

These specifications allow for a production capacity of 20–25 lbs. of clean wool per hour.

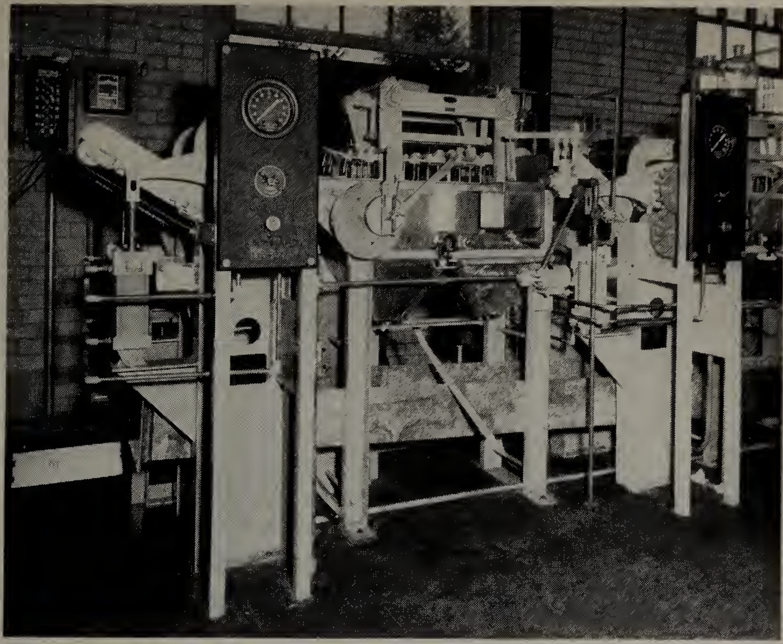
Raw wool is fed into the first bowl by hand onto a feed apron which is attached to the bowl and is chain driven from the rake drive.

The wool is conveyed through the bowl by means of an overhead rake mechanism operated through a cam motion and driven by a variable speed drive with a 3:1 speed ratio. As the wool enters the bowl, a pan ducker submerges the stock and wetting out is achieved immediately. The stock then rises to the liquor surface where it is picked up by the rakes which draw the wool through the bowl to an incline and over a dam from which it falls to the nip of the squeeze rolls.

The liquor displaced by the stock and the liquor carried over in the stock and expelled by squeeze roll pressures drains into a sump under the squeeze rolls and is returned to the bowl by means of a small centrifugal pump. The squeeze roll liquor is returned to the feed end of the bowl through orifices in a pipe which cause jets of liquor to disturb the surface and provide the turbulence desired.

False bottoms are provided for each bowl. These are removable, perforated, stainless steel plates located 6 inches below the top bowl edge. The perforations allow the passage of sediment but retain the wool. Sediment collects in the deep hoppers whose steep walls are kept relatively clean because of the pitch. A cone valve located at the apex breaks compacted sludge when opened for flushing the hopper, while the surging and turbulence of the outflowing liquor does not agitate the sludge appreciably.

Maximum liquor level in the bowl is controlled by the location of the bowl dam fixed at the doffer end.



THE RINSE BOWL, SHOWING DETAILS OF CONSTRUCTION AND CONTROLS

B. *Overflow and Counterflow Systems*

An overflow system is provided which operates through a weir box on the entering end of each bowl. An adjustable dam, or weir, serves as a liquor level control allowing the excess to spill over the weir where it is piped to the squeeze roll pan of the next preceding bowl. This system operates in conjunction with a counterflow system which allows for the introduction of fresh water through a box located on the last rinse bowl. This box is fitted with a ball float connected to a valve which can be set to pass a desired flow of fresh water. The continuing influent flow passes through the overflow system to the preceding bowls providing a counterflow of liquor to the flow of wool being scoured. By this means the wool leaving the train is rinsed in the freshest water while the exhaust of spent liquor meets the incoming grease wool. Hot water is also piped to each bowl to facilitate filling and washing. Introduction of detergent reagents into the bowl is accomplished by a gravity feed from aspirator bottles located on the rack above the bowl.

C. *Recirculation*

The recirculation of liquor from the squeeze roll pan into the scouring bowl mentioned above is accomplished by means of a centrifugal pump which has a controlled rate of from 2 to 5 gals. per minute and ejects streams of liquor into the feed end of the bowl at a mean velocity of 10 feet per second.

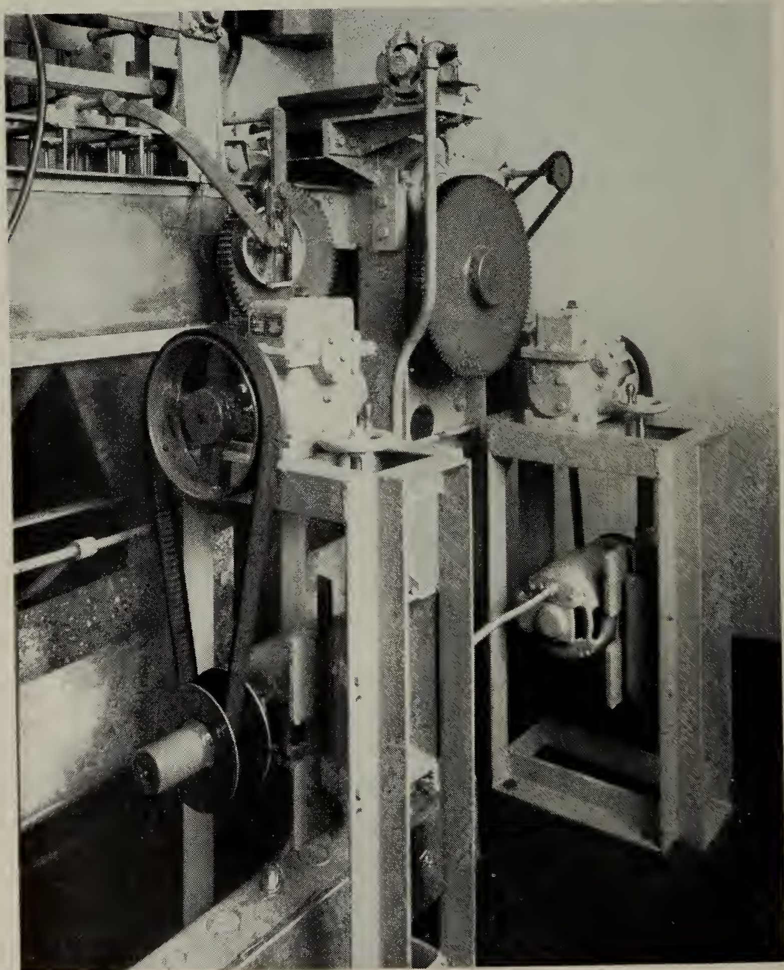
D. *Conveyor*

The rake conveyor system is of stainless construction modeled after the C. G. Sargent's Sons Corp. Model 35. The rake is moved through a relatively short "throw" but the frequency of the stroke is under the control of a variable speed drive with a 3:1 ratio. A ¼h.p. motor is employed. Each stroke of the rake mechanism delivers wool over the crown of the incline without undue tangling and felting action.

E. *Squeeze Roll Machine*

The squeeze roll machine is constructed on a heavy steel frame lined with stainless steel wherever liquor comes in contact with the roll machine parts. The rolls are cold roll steel. The top roll is rubber covered while the lower roll is type 316 stainless steel covered. The lower roll in Bowl No. 2 is knurled to facilitate the movement of high grease wool through the squeeze roll of the first scouring bowl.

Pressure is applied to the rolls by means of a pneumatic pressure system employing air cylinders attached to a lever arm in which the top roll is carried in a fixed position. The lever is pivoted on the squeeze roll frame. This system allows for a wide controlled variation of squeeze roll pressure depending on air pressure applied at the cylinders. The usual conditions obtained in commercial scouring can be simulated at the mean pressures available on the laboratory model. A total of 2 tons pressure is applied at 70 lbs. per square inch giving 368 lbs. per square inch across the nip of the rolls. The pneumatic pressure control allows for a load-lift cycle.



Rake and Roll Drive Mechanism

The squeeze rolls are run by a variable speed drive with a 3:1 ratio associated with a ¼ h.p. motor.

A stainless steel doffer beater is located above the top roll and is driven by an individual 1/20 h.p. gear reduced motor.

The press roll pan under the bottom roll has a false bottom of perforated stainless steel similar in construction to the bowl. A cone valve at the bottom of the pan allows for rapid flushing out of sediment that accumulates at the bottom of the pan.

The total horsepower consumption per bowl is ¾ h.p.

F. Temperature Control

Heat is applied to each bowl individually by means of electric strip heaters of the lo-lag type. These heaters are sheathed in stainless steel and are located directly beneath the false bottoms of the bowls. A bimetallic thermoregulator, operating through a relay, controls the liquor temperature to within plus or minus 1°C.

BY-PRODUCT RECOVERY SYSTEMS

A settling tank is located in conjunction with the second bowl in the train, which is the first scouring bowl. This tank, constructed of stainless steel, is associated with the train so that liquors can be by-passed into it on their return in the recirculating cycle from the squeeze roll pan to the feed end of the bowl. A small centrifugal pump accomplishes the feed to the tank. This tank provides an opportunity for chemical treatment of the liquors when necessary, or it may be employed merely as a settling tank to remove settleable solids previous to centrifugal recovery of the grease. Supernatant liquors or grease-bearing sludges may be passed through a low-speed centrifuge for further sedimentation before being introduced into a super centrifuge for grease recovery.

A Sharples high-speed laboratory model super-centrifuge is used with interchangeable rotors for clarifier or separator operations.

Since the effluent from individual bowls can be collected separately for study by any of the various waste treatment processes under consideration, an opportunity is provided for a more discrete analysis of the wastes arising at different stages of the process. The effluent from the first bowl, for instance, where desuinting is the primary achievement, may be influenced by control of the conditions in that bowl so as to lend it more amenable to biological treatment, i.e., trickling filters. In this regard a trickling filter or activated sludge unit will be operated to receive the desuinting liquors alone or the degreased liquors which represent a high percentage of the total five-day B. O. D. of combined wool scouring wastes. Other processes, such as those employing ion exchange resings, may be investigated as treatment of waste from individual bowls or of combined, selected wastes arising at specific stages in the scouring process.

Concomitant with the investigation of waste treatment of effluents from conventional scouring operations, we have the opportunity to study the scouring process in controlled detail with an aim toward the modification of the process so as to yield effluents which demand less costly and simpler treatments to make them acceptable to the streams. The advantages to be gained by the use of the laboratory model scouring train results from the higher degree of precision in control of conditions, reduced cost of experiments realized through the use of small quantities of wool and chemicals, greater facility in operation, and smaller volumes of effluents to employ in treatment studies.

Results of the research progress achieved by the use of this equipment will be reported elsewhere.

ACKNOWLEDGMENTS

The engineering staff of C. G. Sargent's Sons Corp., Graniteville, Massachusetts, contributed the major portion of the design of this apparatus as well as overseeing the construction of the equipment in their plant. We wish also to acknowledge the contributions of the many wool manufacturers whose suggestions and recommendations served to guide the work. Members of the staff of the Wool Department of the Lowell Textile Institute have contributed their time and experience in the furtherance of this project.

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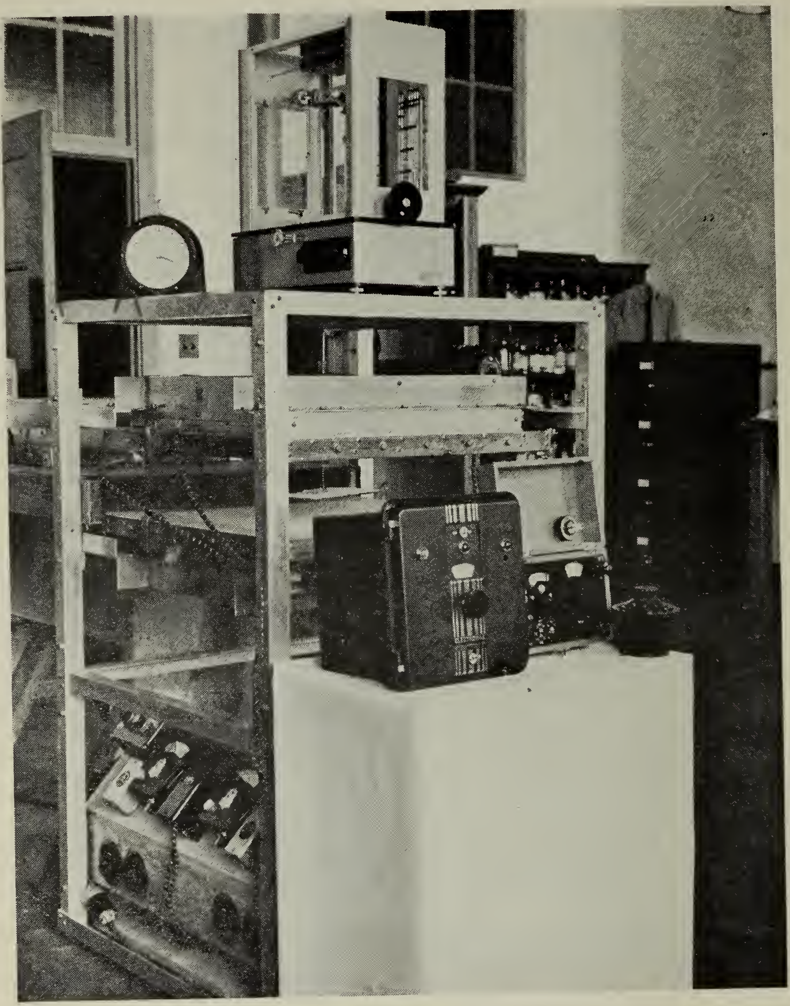


FIGURE 4.

INFRA-RED HEATING AND DRYING

by

GEOFFREY BROUGHTON*

INTRODUCTION

The heating and drying of materials in the web form by infra-red radiation or radiant heat is becoming of greater and greater interest to the paper and textile trades every day (1, 2). In a conference held to discuss drying methods (1), one of the conclusions drawn was that "the electric infra-red method is applicable to the continuous drying of thin textile material and should be seriously considered as a competitor of steam in this field." Where contact of material with steam cylinders is undesirable for one reason or another, it is particularly indicated. In view of this, it is perhaps surprising to find that of the three mechanisms of heat transfer, conduction, convection and radiation, the last is probably the least understood. The former require contact between hot and cold matter for heat transfer to occur, while the last depends only upon infra-red rays, wave-length 0.7μ or greater, which can pass without contact, if necessary even through a vacuum, from the hotter to the cooler body.

CONDUCTION AND CONVECTION

Conduction and convection follow well known laws (3), the common characteristic of which is that the heat transfer is proportional to the temperature gradient between the cold and hot bodies. Expressed mathematically,

$$dq/d\theta = \frac{K\ A\ (T_1\text{-}T_2)}{L} \qquad (1)$$

where $dq/d\theta$ is the rate of heat transfer from a material at temperature T_1 to another at temperature T_2 over an area A and through a distance L. K is a constant (proportional to the conductivity or heat transfer coefficient as the case may be). For transfer by conduction and convection, contact between the hot and cold materials is necessary and, in heat transfer by convection, its rate will depend upon the magnitude of their relative motion. This is because of the necessity for heat transfer through the stagnant film at a solid or liquid surface; high velocities naturally cutting down the thickness, and hence the resistance to heat transfer, of this layer. Thus, drying of paper is greatly accelerated by high air velocities, even though the temperature gradient remains constant because the coefficient K of equation (1) increases approximately as the eight-tenths power of the air velocity.

RADIATION

Heat transfer by radiation can be of great value in the heating and drying of textile and paper webs because of the possibilities of uniform application from a source some distance from the web, allowing its ready addition to many types of machinery, together with more rapid transfer of heat energy than is possible with air convection ovens. Gas flames, infra-red lamps, strip heaters and fiberglas covered nichrome wire heaters, the last perhaps giving the greatest uniformity, have all been used as sources of infra-red radiation.

* Professor and Head, Department of Paper Engineering, Lowell Textile Institute.

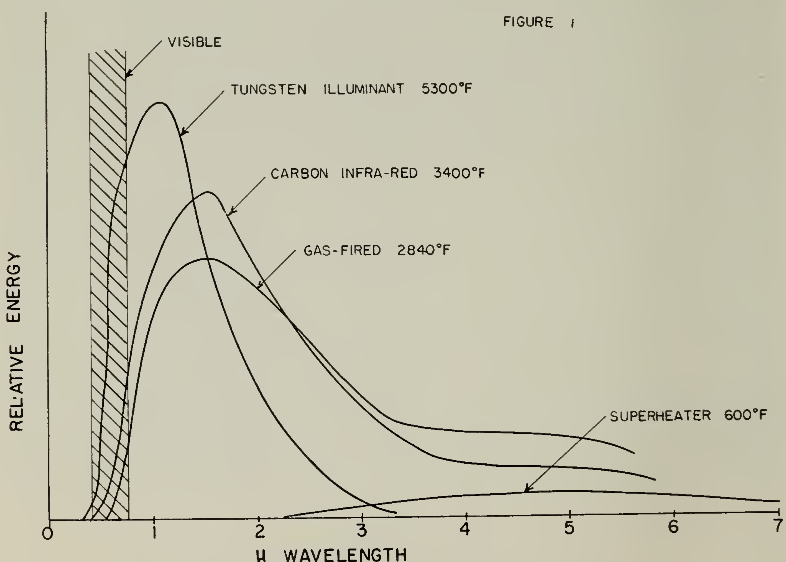
In considering infra-red heating and drying, several principles must be studied. Every material emits infra-red radiation, generally considered to be that portion of the electromagnetic spectrum lying above the visible red i.e. above 0.7μ wave-length. The amount and quality (or wave-length distribution) of the emitted infra-red radiation is a function only of the absolute temperature of the material and its surface emissivity. Thus, the heat emitted is:—

$$dq/d\theta = A\ T^4 \tag{2}$$

where T is the absolute temperature and A is a constant proportional to the emissivity of the surface (a so-called "black body" has the highest possible emissivity, unity). From a consideration of this equation, it will be seen that the heat emitted from a radiator or source rises very rapidly with its temperature, accounting for the fact that in equipment at very high temperatures, e.g., a black ash furnace, most heat transfer is by radiation rather than by conduction and convection.

The quality or wave-length distribution of the infra-red radiation emitted from a radiator depends only upon its absolute temperature. As this rises, the maximum of the wave-length distribution curve moves towards the visible spectrum or decreases in wave-length. Figure 1 shows the spectrum distribution of a number of well known infra-red sources. A very convenient device for calculation of the amount of infra-red radiation emitted at a given temperature and also its wave-length distribution is the radiation slide rule obtainable from the General Electric Company (4).

FIGURE 1



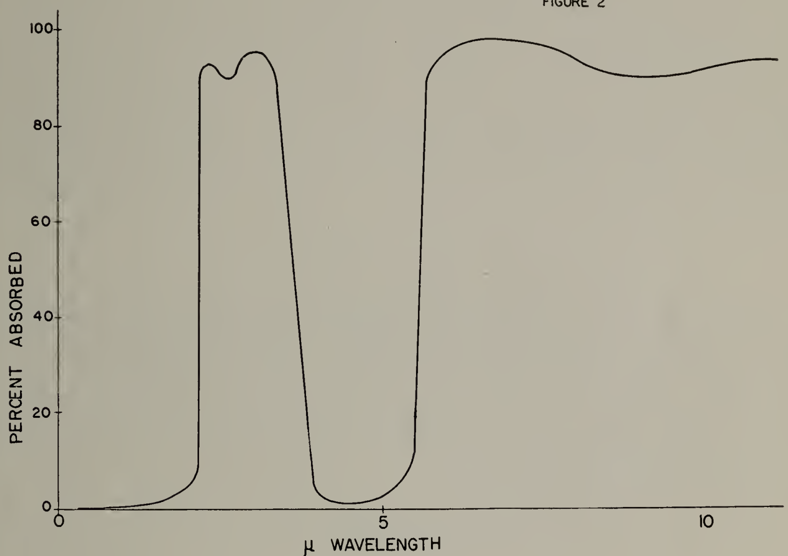
Just as visible light can be reflected, transmitted or absorbed when it strikes a material, dependent on the optical properties of that material, so can infra-red rays be reflected, transmitted or absorbed. Only in the last case, does the radiation heat up the material or, from the usual point of view, perform a useful function. Different materials have different absorption characteristics for the various wave-lengths in the infra-red and hence will behave differently when exposed to infra-red radiation. As stated by Marshall and Friedman (5):— "Penetration of the radiant energy into the solid will depend on the wave-lengths involved and on the absorption characteristics of the solid." Thus, many dyes

which differ strongly in their absorption characteristics to white light are identical in their behavior to the longer infra-red (6).

HEATING BY INFRA-RED

In the case of a thin material, the infra-red radiation should match its infra-red absorption spectrum for most efficient heating. This makes the quality or wave-length distribution (Figure 1) of the infra-red heater for a specific job of great importance, since only that portion of the infra-red rays absorbed is useful in raising the web temperature. Consider, for example, the heat setting of a nylon web. Figure 2 shows diagrammatically the infra-red absorption spectrum of a nylon sheet, 0.004 ins. thick. Clearly, little energy will be

FIGURE 2



absorbed from infra-red radiation of wave-lengths less than 6μ. An infra-red source at relatively low temperature, with the major part of its energy in wave-lengths above 6μ is indicated for greatest utilization of the heat supplied. A high temperature source, such as the ordinary infra-red bulb, showing 95% of its total energy emitted in wave-lengths below 6μ, would have little heating effect on the nylon web. In practice, low temperature radiation sources, such as the fiberglas mat heaters, are found to be excellent for heat setting nylon.

If the material is thick, its absorption spectrum becomes of less importance; a material will, of course, always absorb more and more radiation as its thickness is increased. Paper of ordinary thickness (3 thousandths of an inch or greater) is practically opaque across the infra-red spectrum.

Table I indicates the more important absorption bands in the infra-red for some common plastics.

TABLE I

More Important Absorption Regions of Some Common Plastics

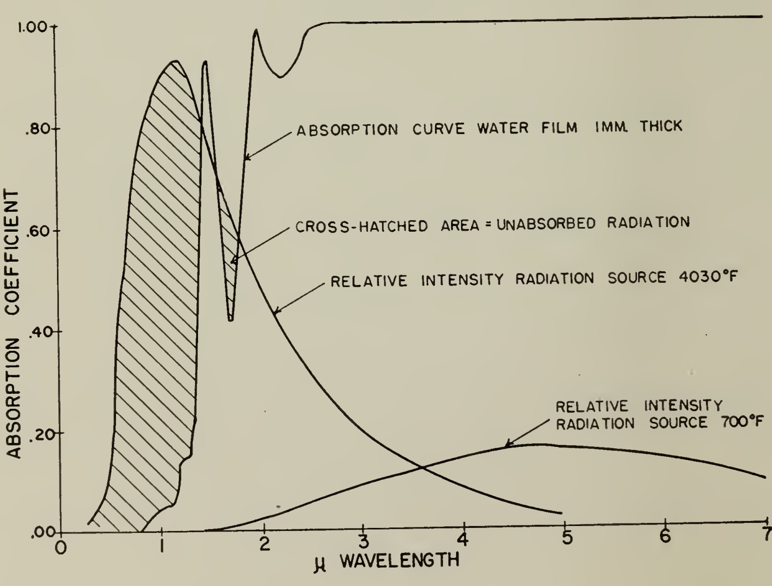
Polystyrene (7)	3.2, 6.5-7.0, 9.5, 12.5-14μ
Gelatin (7)	2.9-3.8, 6-8,
Polyvinyl acetate (7)	5.8, 7-11
Glyptal resin (7)	2.9, 5.8, 7.9, 8.8-9.8
Shellac (7)	3-3.5, 5.8, 7-10.5
Paraffin M.Pt. 68-72 C (8)	High absorption to 13
Nitrocellulose (8)	6, 7.5, 8.5-10.5, 11-12.5
Ethyl cellulose (9)	9
Pliofilm (9)	8-9
Cellulose acetate (9)	7.5-9.5
Cellophane (9)	4-6, 8.5-10, 12-20
Vinyl resin (9)	5.7, 6.5-8.3
Rubber (9)	No marked absorption bands

Reflectivity can become important, particularly if plate-like materials, e.g., flake aluminium, are incorporated in the resin film. Thus, in the case of a polystyrene varnish, transmission was cut down almost to zero by addition of 5% aluminium pigment, presumably due to reflection of the incident infra-red radiation.

DRYING BY INFRA-RED

In heating water for evaporation, i.e. drying, absorption characteristics again may be expected to be important. Water first starts to absorb strongly at 1.4μ. Figure 3 indicates diagrammatically that for a film 1 mm thick about 60% of the energy from a high temperature source should be absorbed, while over 99% of the radiation from a low temperature source at 700° F. should be absorbed. Thus, the use of low temperature radiation should lead to savings in electrical energy if both low and high temperature sources of infra-red radiation are electrically heated.

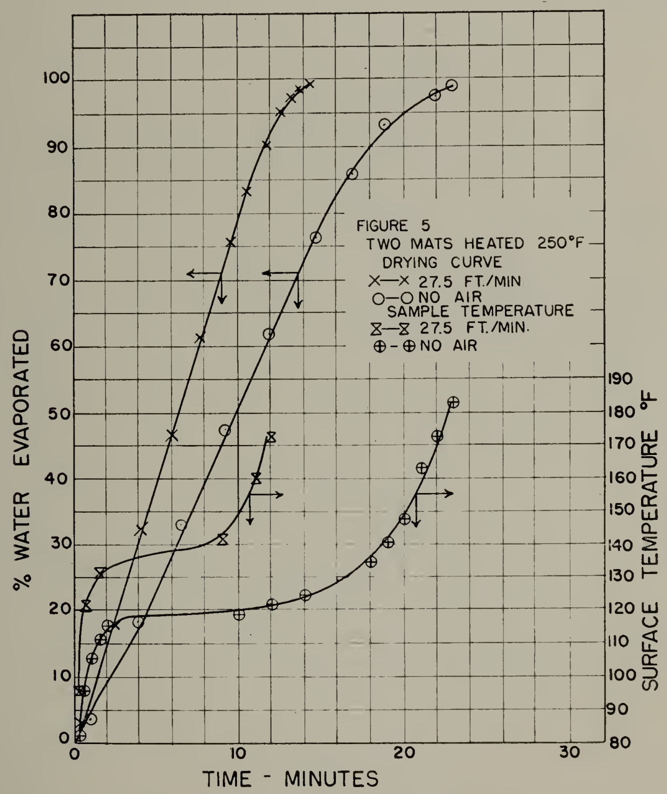
FIGURE 3



Experiments made in the drying of clay-casein coating mixtures on paper comparing high temperature (lamps) with low temperature (fiberglas mat heaters) infra-red sources indicate that this is true. Measuring electrical input to the heaters and pounds of water evaporated under comparable conditions, considerably greater efficiencies were observed for the low temperature radiation source. In the latter case, efficiencies of over 70% were found.

EXPERIMENTS WITH FIBERGLAS MAT HEATERS

Some interesting work has been conducted at the Institute using an experimental drier (Figure 4), for which the author is indebted to Industrial Radiant Heat Corporation, Gladstone, N. J. The specimen under investigation is suspended from a balance arm between two of the glass mat heaters, either or both of which can be maintained at any desired temperature from 200° to 700° F. by a Leeds and Northrup Electromax Controller. Temperature of the specimen can be measured in the usual way with copper-constantan thermocouples. The rapid weighing balance allows the weight to be determined at any time interval so that a drying curve can be obtained. The glass mat heaters can be operated without air or, by means of a small blower attached to the back of each mat, air velocities up to 30 ft./min. through and perpendicular to the mat surface can be obtained. Power input to the heaters can be measured with a watt-hour meter.



Using this equipment it is easy to show that pulp, paper and textiles give typical drying curves, showing constant and falling rate periods (Figure 5). Furthermore, the constant drying rate, found to be almost the same for all

materials at a given temperature (Table II), increases rapidly with glass mat temperature (Figure 6) as would be expected from Equation (2).

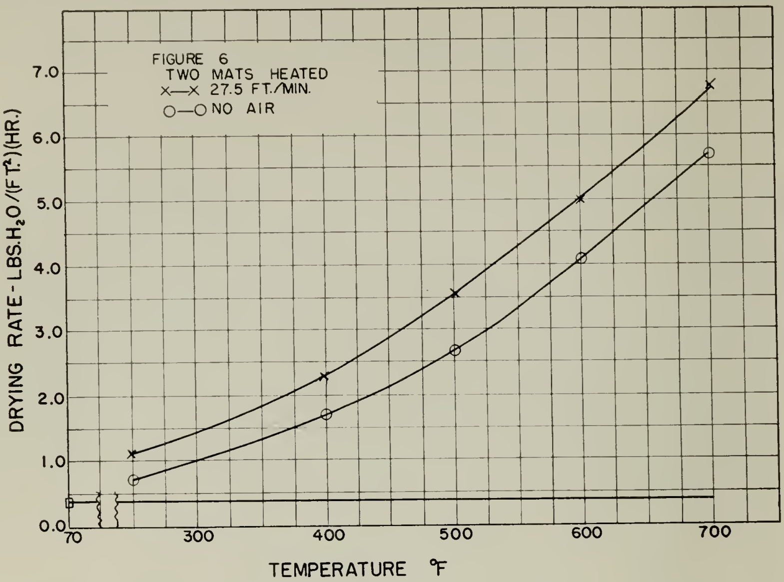


TABLE II

Rates of Drying for Various Materials During Constant Rate Period

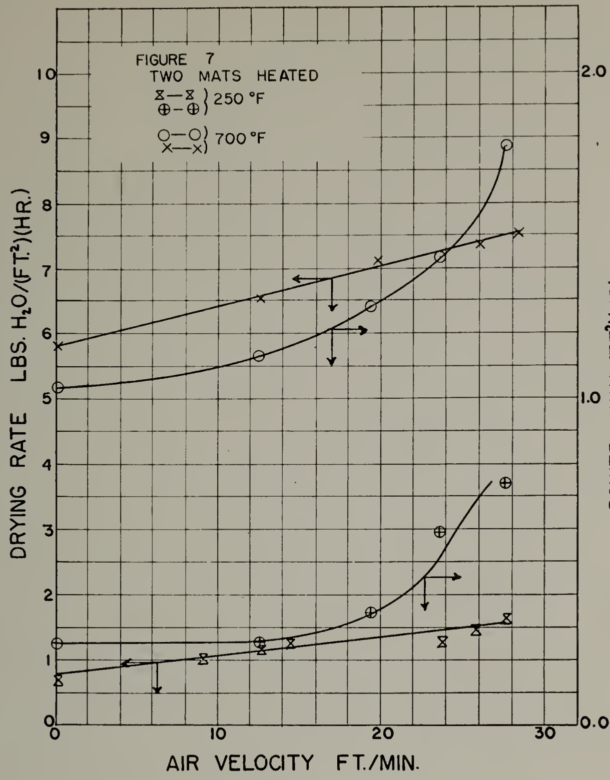
Material	Mat Temperature	Drying Rate
White sulfite pulp (.039 in. thickness)	700°F	5.8 pound/(hour) (sq.ft.)
White blotting paper (.021 in. thickness)	700°F	5.75
Hard felt (5/16 in. thickness)	700°F	5.8
Loose felt (5/16 in. thickness)	700°F	5.9
White sulfite pulp (.039 in. thickness)	250°F	0.71
Black sulfite pulp (.039 in. thickness, dyed with Pontamine Black L)	250°F	0.75
Asbestos paper (.021 in. thickness)	250°F	0.71
Unbleached cotton print cloth (.012 in. thickness; weight 1.2 oz./sq. yd.)	250°F	0.70

Air, by cutting down the resistance of the stagnant air film, accelerates drying but leads to increased power consumption due to the fact that it is heated as it passes through the glass mat heater (Figure 7). Thus, with the mat surface temperature at 700°F and an air velocity of 27.5 ft./min. the air leaving the heater surface has a temperature of 540°F. Convectional drying is seen to be relatively more important at low mat surface temperatures. The data suggest that, for a continuous web drier, there is an optimum air velocity at any temperature where savings in capital cost due to decreased dried length balance an increase in fixed charges due to higher power requirements for heating the air. This air velocity will be lower the higher the drier temperature.

CONCLUSIONS

In the installation of infra-red heating or drying equipment, considerable thought should be given to the infra-red absorption characteristics of the material to be treated and to the characteristics of the infra-red heater as well as to such factors as uniformity of heat across the web, maintenance, etc. Choice of correct air velocity is also important.

There are now available infra-red heaters operating at temperatures from 250°F to 5000°F with corresponding wave-length emissions. While heaters



operating at high temperature may have high radiant energy emissions per unit area, their efficiency may be lowered because of their emission of low wave-length radiation. Only careful consideration of the factors involved will allow prediction of the most efficient source of infra-red radiation in terms of both space and electrical or other form of power used. When this is done, infra-red heating or drying assumes a more competitive position for application in the paper and textile fields.

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Mrs. Doris T. Couture

BULLETIN
OF THE
Lowell Textile Institute

Catalogue Issue for 1951 - 1952 Session

Textile and Colonial Ave. Lowell, Massachusetts

The Campus

1. Southwick Hall
2. Kitson Hall
3. Falmouth Street Building
4. Pasteur Hall
5. Smith Hall — residence hall
6. Eames Hall — residence hall
7. Alumni Memorial Library
8. Paper and Leather Building (Under construction)
9. Administration — Auditorium Building (authorized)
10. Engineering — Research Building (proposed)
11. Residence Hall (proposed)
12. Residence Hall (proposed)
13. Power Plant
14. Athletic Field

Alumni Memorial Library

SERIES 54, No. 4

BULLETIN

OF THE

Lowell Textile Institute

LOWELL, MASS.

Issued Quarterly

1951

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State Purchasing Agent

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The Institute reserves the right to make changes in the regulations and courses announced in this Bulletin.

SPECIAL ANNOUNCEMENT

SPECIAL ANNOUNCEMENT

The Secretary of Defense for Air announced on April 20, 1951 that an Air Force Reserve Officers' Training Corps unit will be established at Lowell Textile Institute. The instruction will begin with the opening of the first semester in September 1951.

The information was received too late for the details to be included in this issue of the catalog but the ROTC program will be integrated with all curricula. Details of the changes in curricula will be announced soon and the changes will be effective September 1, 1951.

By vote of the Board of Trustees, all able-bodied male students enrolling in Lowell Textile Institute for the first time on or after September 13, 1951 will satisfactorily complete the basic ROTC work (freshman and sophomore years) before receiving a Bachelor of Science degree. The President of the Institute may waive this requirement and permit the substitution of an equivalent amount of work only for those individuals who are not liable to military service under existing laws and regulations (for example, not a citizen of the United States, previous military service, etc.)

The basic course, required for all male freshmen and sophomores, involves two recitation classes and one one-hour drill period each week. Those students, who show a promise of leadership ability, may be selected to take the Advanced Course. If they elect to take advantage of this opportunity, they will take three recitation classes and two one-hour drill periods each week and, in addition, will be required to attend a summer camp between their junior and senior years. Those students, who satisfactorily complete the Advanced Course, will be commissioned as Second Lieutenants in the United States Air Force Reserve upon graduation.

Uniforms (for students in the Basic Course) and all equipment and textbooks required for the ROTC work will be supplied by the United States Air Force. Students taking the Advanced Course will receive from the Air Force a cash allowance toward the cost of their uniforms which become their property upon graduation. In addition, the students in the Advanced Course will receive the standard cash payment allowed by the Air Force in lieu of subsistence.

INSTITUTE CALENDAR

FOR

1951

September 12, Wednesday, 9:30 A.M.	First semester begins for freshmen
September 17, Monday, 9:00 A.M.	Registration of all other students. Late registration fee applies after today.
September 18, Tuesday, 2:00 P.M.	President's Convocation. Required for sophomores, juniors and seniors.
September 19, Wednesday, 8:30 A.M.	All classes begin
October 2, Tuesday	Last day to register for new classes
October 12, Friday — Columbus Day	Institute closed
October 17, Wednesday	Last day to drop classes without penalty grade
November 12, Monday — Armistice Day Celebration	Institute closed
November 21, Wednesday, 11:20 A.M. to November 26, Monday, 8:30 A.M.	Thanksgiving recess
December 21, Friday, 4:20 P.M. to January 7, Monday, 8:30 A.M.	Christmas recess

1952

January 7, Monday, 8:30 A.M.	Classes resume
January 21, Monday, 8:30 A.M. through January 30, Wednesday, 4:20 P.M.	First semester examinations
February 4, Monday, 9:00 A.M.	Registration for second semester. Late registration fee applies after today.
February 5, Tuesday, 2:00 P.M.	President's Convocation. Attendance required for all students.
February 6, Wednesday, 8:30 A.M.	All classes begin
February 19, Tuesday	Last day to register in new classes
February 22, Friday — Washington's Birthday	Institute closed
March 5, Wednesday	Last day to drop classes without penalty grade
April 1, Tuesday, 4:20 P.M. to April 9, Wednesday, 8:30 A.M.	Spring recess
May 21, Wednesday, 8:30 A.M.	Senior examinations begin
May 28, Wednesday, 8:30 A.M. to June 6, Friday, 4:20 P.M.	Second semester examinations
May 30, Friday — Memorial Day	Institute closed
June 9, Monday	Commencement

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Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

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Ernest P. James, '42, *Assistant Secretary*

HISTORICAL SKETCH OF THE LOWELL TEXTILE INSTITUTE

The Lowell Textile Institute, formerly known as the Lowell Textile School, was incorporated under the laws of Massachusetts in 1895 and functioned as a private institution and a recipient of state aid for several years following its inception. Its formal opening took place on January 30, 1897 with a teaching staff of thirteen and a student body of thirty-three. The school occupied rented quarters in downtown Lowell until the completion of Southwick Hall, the first of its present buildings, in January, 1903. The property of the school was transferred to the Commonwealth of Massachusetts in July, 1918 and since that time control and management have been vested in a Board of Trustees appointed by the Governor.

The name of the school was changed to Lowell Textile Institute in 1928 in order to indicate more clearly the standing of the institution.

In December, 1948, the Institute was accepted to full membership in the Senior College Division of the New England Association of Colleges and Secondary Schools. The United States Department of Education and the Armed Forces consider such membership equivalent to regional accreditation.

PURPOSE AND SCOPE OF THE INSTITUTE

According to the original act authorizing its establishment, the Institute was founded "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry". Throughout the years it has steadily broadened its scope both in physical equipment and educational service, keeping pace with the progress of the industry it serves. In a continuing effort to render the greatest possible educational opportunities to the Commonwealth, the program of the Institute was broadened, in September, 1950, to include curricula in Paper Engineering and Leather Engineering.

During the early years of the Institute's existence, in keeping with its initial educational objectives, no degrees were offered but diplomas were given for the completion of specified courses of study. However, in 1913, the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C.) were conferred on those students who completed four years study in one of the several curricula offered at the Institute. Gradually, all diploma courses were discontinued and all vocational work was transferred to the Lowell Evening Textile School program which is described in another bulletin.

In response to a continued demand for advanced study in Textile Chemistry, Textile Engineering or Textile Manufacturing, the Institute initiated graduate programs in these fields and awarded its first Master of Science degrees in 1935.

Recognizing that the general trend of its educational service, as reflected in its various curricula, has been constantly broadening in scope, the Institute is now offering the degrees of Bachelor of Science in Textile Chemistry, in Textile Engineering, or in Textile Manufacturing. The first of these degrees were conferred in 1947.

With the inauguration of the new Paper Engineering and Leather Engineering courses, the degrees of Bachelor of Science in Paper Engineering or Bachelor of Science in Leather Engineering are offered to graduates in these fields. Graduate study programs in either of these fields lead to the corresponding Master of Science degrees.

The curricula of the Institute are under constant study. Revisions are made whenever it is clearly indicated that changes are necessary in order for the Institute to fulfill its traditional purpose of service to the industries. In choosing the

present curricula, the Administration and Faculty have been aware of their obligation to prepare students for entrance into the industry of their choice whether it be the Textile, Paper, Leather, or similar fields. In addition to fundamental courses in the physical sciences and engineering, considerable work in practical industrial applications has been included. Broadening yet practical courses in English and the social sciences have been woven into all curricula in a conscious effort to produce graduates who are not only well trained technically but are prepared to take their places in society. It has been recognized in the preparation of these curricula that no college program can adequately produce a specialist. The aim is to provide the student with a solid fundamental background and to predispose him to obtain additional and specialized education after graduation.

COEDUCATIONAL

Within the last few years, the possibilities for women in certain branches of the textile field have become recognized; and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, since it offers a broad training that prepares for many lines of activity. For those who wish to specialize in structural and decorative textile designing, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

THE INSTITUTE

Lowell Textile Institute is located in Lowell, a city of 100,000, long famous as a great center of the textile industry. The campus occupies a commanding site on the west bank of the Merrimack River, overlooking the rapids of Pawtucket Falls, which furnished the first extensive use of water power in America for the operation of power loans. The 15 acres which constitute the main campus were given by Frederick Fanning Ayer, Esquire, and the Proprietors of the Locks and Canals on the Merrimack River.

BUILDINGS

Southwick Hall — faces southwest on Textile Avenue, and forms the southwest side of the great quadrangle. The offices of the President, Dean of the Faculty, Dean of Students, Registrar, Admissions, the Business Officer, and the Department of Engineering and Finishing are housed in the north wing; the Departments of Chemistry and Dyeing, in the south wing. The central section which houses the gymnasium and the Assembly Hall is pierced by an archway which gives access to the central courtyard. Erected in 1902 by contributions of the Commonwealth of Massachusetts and Mr. Frederick Fanning Ayer as a memorial to Royal Southwick, a leading textile manufacturer, and a public man of earlier days, and a maternal ancestor of Mr. Ayer.

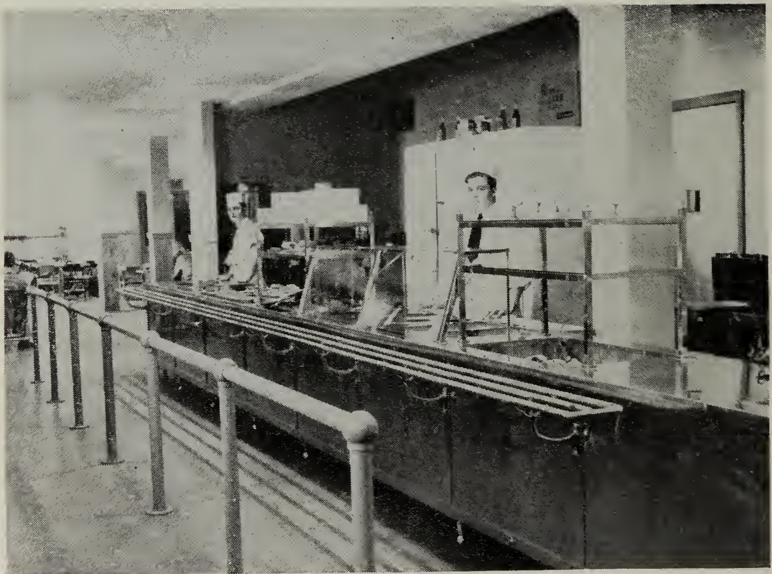
Kitson Hall — forms the northwest side of the quadrangle. It houses the Cotton Yarn and Knitting Departments, the Mechanical and Electrical Engineering laboratories, and the Machine Laboratory. Erected in 1902 as a memorial to Richard Kitson, founder of the Kitson Machine Company of Lowell and a leading manufacturer of the city, by gifts from Charlotte P. Kitson and Emma K. Stott, his daughters, and the Kitson Machine Company.

Falmouth Street Building — forms the northeast side of the quadrangle. It houses the picker section of the Cotton Yarn Department, the Departments of Design and Power Weaving, Woolen and Worsted Yarn, and Synthetic Textiles. Erected in 1903 as a one-story building, and finally enlarged to its present capacity in 1907 by the Commonwealth of Massachusetts.

Louis Pasteur Hall — forms the southeast side of the quadrangle. It houses

Smith Hall

Cheer Leaders of 1951



Cafeteria

the Cotton Finishing Laboratory, the offices of the Wool Department, research laboratories of the Chemistry, Textile Coloring, and Finishing Department, laboratories, classrooms, lecture rooms, and, currently, the library. Originally constructed as a one-story building, in 1910, it was subsequently enlarged to three stories, in 1937, by the Commonwealth of Massachusetts.

Paper and Leather Building — extends northwest from the Falmouth Street Building. When completed, it will house the Departments of Paper Engineering and Leather Engineering, with extensive floor space allotted to the Physics Section. To be completed by September 1, 1951, through funds appropriated by the Commonwealth of Massachusetts.

Alumni Memorial Library — across Textile Avenue, faces northeast and the great quadrangle. It has a book stack capacity of 80,000 volumes, reading rooms which will seat 150 students, complete facilities for library operation and administration, committee and exhibition rooms, alumni offices, and offices for student activities. Of Colonial Georgian architecture, erected by contributions of alumni and interested members of the textile industry, and dedicated as a memorial to Lowell Textile men and women who served in the First and Second World Wars, this building will give the Institute the modern and efficient library for which a vital need has so long existed. It will be completed in the fall of 1951.

Smith Hall — faces the great quadrangle, slightly to the rear and to the left of the Library. Men's residence hall with accommodations for 112 students and a faculty proctor, a dispensary for students, and quarters for the resident nurse. The college cafeteria, in the basement, caters to all students and the faculty. It is dedicated in honor of James T. Smith, pioneer educator in the textile field, the individual primarily responsible for the organization of Lowell Textile Institute. Erected in 1948 by the Lowell Textile Institute Building Association.

Eames Hall — faces the great quadrangle, on a line with Smith Hall, and to the right of the Library. Men's residence hall with accommodations for 112 students, plus an apartment for a married faculty proctor. Also has a Student Lounge and Snack Bar, fully equipped for lounging and recreation. It is dedicated in honor of Charles H. Eames, President of the Institute, 1905–1945. Erected in 1949 by the Lowell Textile Institute Building Association.

Power Plant — northeast and rear of great quadrangle.

Athletic Field — northeast of main campuses. First used for baseball in 1938, this area is being further improved to provide a modern athletic center for baseball and other sports.

EQUIPMENT

Now housed in the various building of the quadrangle is an extremely varied set of textile machinery covering all of the basic systems for handling staple and continuous filament fibers, from raw material to finished products, including special types of looms, and lace making machinery. The Paper and Leather Building will house the machinery essential to instruction in all phases of the manufacture, control, and testing of all grades of paper and leather. All machines and equipment will, as now, be closely integrated with modern laboratories in physics, chemistry, and engineering, and in chemical, physical, and optical testing. All laboratories, including those with machines which are exact replicas of commercial models, are geared to both teaching and research.

SPECIAL SERVICE

In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract with responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

RESEARCH

Two major projects are under investigation in the Research Department. Both of these are sponsored by outside agencies but facilities are provided by the Institute.

The oldest project is under the sponsorship of the Research and Marketing Administration of the United States Department of Agriculture and is an investigation of the properties of cotton yarn. The ultimate aim is the development of end-use performance characteristics which will enhance their behavior as fine-chain warps in carpet backing fabrics. Studies of yarn geometry and physical-chemical character are being employed to guide an engineering design for a better cotton yarn structure and thus obtain better end-use performance.

The second project is being pursued in cooperation with the Massachusetts Department of Public Health and is sponsored by the Federal Security Agency of the United States Department of Public Health. This work is aimed toward a solution of wool scouring waste disposal in so far as it influences both stream and aerial pollution. Although stream pollution abatement is the primary motivation behind this work, new processing techniques are being studied to improve scouring procedure and to present to sanitary engineering a more tractable waste for treatment. Concomitantly, studies in by-product recovery and utilization are being undertaken in the interest of reducing the economic burden of waste disposal.

GENERAL INFORMATION

ADMISSIONS

New students at the Lowell Textile Institute are selected by a group of Faculty members functioning as the Committee on Admissions. The Committee endeavors to accept for membership in the freshman class those applicants who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership. In addition to test results, scholarly attainments, and other traditional standards of measurement, the Committee sets a high value on the personality characteristics of each individual candidate, together with his extracurricular interests and contributions to school and community life.

PROCEDURE

Formal application for admission should be made as early as possible in the candidate's senior year of secondary school. Requests for application blanks and all correspondence relating to matriculation at the Institute, should be addressed to the Director of Admissions. Preliminary correspondence before the senior year is welcomed, and encouragement is extended to every effort which will tend to harmonize the prospective student's interests and activities with his freshman year at the Institute.

Steps to be taken for admission are:

1. Pages one and two of the admission application form should be completed by the candidate.

2. The whole application form should then be submitted to the office of the candidate's secondary-school principal, with the request that his office fill out pages three and four and mail the completed application directly to the Director of Admissions.

It is required that this procedure be accomplished by March 1, if the candidate wishes to be considered for admittance to classes beginning the next September. It is the responsibility of each individual applicant to ensure that his application has been properly completed and sent to the Committee at the Institute before March 1.

3. The candidate should make direct application to the *College Entrance Examination Board P.O. Box 592, Princeton, New Jersey,* requesting to take certain examinations described below under the heading *Requirements.*

4. Each applicant must submit to a complete health examination by his family physician. A certificate of good health, indicating the date of this examination, must then be sent by the physician to the Director of Admissions. The Committee has prepared a special form for the convenience of the physician; a copy of this certificate of health will be supplied.

5. A personal interview with the Director of Admissions is strongly recommended. The Office of Admissions at the Institute is open for this purpose Monday through Friday, from 8:30 a.m. to 4:00 p.m. during the school year. It is urged that appointments for an interview be made in advance.

REQUIREMENTS

Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision as to the eligibility of an applicant shall be left to the discretion of the Committee on Admissions.

The conditions under which an applicant may be accepted are as follows:

1. A candidate for admission must be a graduate of a secondary school ap-

proved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of equal scholastic standing.

2. (a) Because of the specialized nature of the various curricula at Lowell Textile Institute, it has been deemed advisable that all entering students shall have completed the following units of secondary-school study:

Algebra (quadratics and beyond)	2 units
Plane Geometry	1 unit
English	4 units
American History	1 unit
Chemistry (including laboratory)	1 unit
or	
Physics (including laboratory)	1 unit

Preference will be given to applicants offering both Chemistry and Physics. In addition to the above-listed prerequisites, each applicant must offer credit in elective subjects, such as: languages, other than English; history, other than American; mechanical drawing, solid geometry; advanced algebra; scientific subjects; social studies; and others. Trigonometry is recommended but not required.

(b) The combined prerequisites and electives should total at least 15½ Carnegie units. Each such unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week, or the equivalent.

(c) In evaluating the credits offered by an applicant for admission, the Committee will be guided primarily by the quality of his scholastic record and by his apparent promise on grounds of intellect and character. Therefore, an applicant whose preparation has not followed the normal pattern with respect to the accumulation of unit credits should not hesitate to apply for entrance, provided that the quality of his scholarship gives evidence of ability to do college work and provided that he is recommended by his school. (For additional information, see paragraph "Exceptions to Admissions Rules", below.)

3. All candidates must arrange for and complete the following tests which are given by the College Entrance Examination Board:

(a) Morning Program — The Scholastic Aptitude Test (Verbal and Math Sections) (three hours)

(b) Afternoon Program — an Achievement Test in each of the following:

Pre-Engineering Science Comprehension
Physics
or
Chemistry
Intermediate Mathematics

These examinations are prepared, administered, and graded independently of the Lowell Textile Institute. Therefore, as explained under Procedure, application to take the tests must be made directly to the College Entrance Examination Board, P.O. Box 592, Princeton, New Jersey. Arrangements to take the tests, which are scheduled annually for the early part of March, should be completed as early as possible in the candidate's senior year in secondary school. Foreign students, particularly, should plan to make early arrangements, so that testing facilities can be set up near their homes. The examinations are given at various cities, throughout the world, so that no candidate should be placed under undue hardship in taking the tests.

Questions concerning the nature and scope of the tests, the location of testing centers, financial considerations, and the like, should be addressed directly to the

College Entrance Examination Board. It is the full responsibility of each candidate for admission to Lowell Textile Institute properly to arrange for and complete the required tests. He should also inform the Board that he wishes the results forwarded to the Director of Admissions.

Advanced Standing — A few exceptionally well-qualified students are admitted to advanced standing each year. Such candidates must submit their qualifications on a special form which must be filed before March 1, if the applicant expects to enter classes beginning the next September; — before November 1, for second-semester classes. The Advanced Standing Petition should be filed in addition to and independently of the regular admissions application; the former should be sent directly to the Director of Admissions by the candidate himself; the latter should be sent to the Committee by the candidate's secondary-school principal.

Exceptions to Admission Rules — In special cases, at the discretion of the Faculty Committee on Admissions, applications may be accepted from candidates in the following categories:

1. Applicants who lack credit in specified required subjects because they are not offered in the course of study at their secondary school. Such applications will be considered only when the quality of work done in other departments is exceptionally high.

2. Applicants who offer credit in all the required subjects, but whose accumulation of unit credits does not total 15½. Very few students will find themselves in this category, because most secondary schools require at least 15½ units for graduation. However, the Committee is willing to recognize the possibility that a student, well-qualified in all other respects, should not be denied the opportunity to submit his application because of purely quantitative considerations.

3. Applicants who have not maintained a uniformly good scholastic average in all subjects, *but are otherwise acceptable,* may be required to pass certain tests given by the College Entrance Examination Board. These tests will be in subjects prescribed by the Committee on Admissions, and usually will be in addition to the examinations regularly required of all candidates.

4. Applicants from secondary schools which are not on an accredited list may be required to pass the tests of the College Entrance Examination Board in those subjects prescribed by the Committee on Admissions, in addition to, or in substitution of, the tests regularly required of all candidates.

TRANSFER STUDENTS

Transfer students are expected to have demonstrated outstanding ability, must submit transcripts of their college record and letters of honorable dismissal, and must supply cogent and positive reasons for wishing to enroll at Lowell Textile Institute. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

Because of the nature of the course of study at the Institute, it is usually difficult for a transfer student to construct a program which will be completely satisfactory. In general, a transfer can be accomplished only at the expense of sacrificing some time and credit. With that thought in mind, the Committee entertains consideration of advanced standing aplications only when they include a well-developed plan of study, which the candidate submits as being acceptable and suitable for his purpose. The Director of Admissions and/or the Registrar will gladly advise prospective applicants concerning this plan of study, and other matters concerned with advanced standing, by means of correspondence, or interview, or both.

FOREIGN STUDENTS

Occasionally, an undergraduate may leave the Institute to study elsewhere after which he wishes to return to the Institute. Re-entry under such conditions is by no means automatic. Each application will be considered in the light of its individual merits. Credit for courses taken at other institutions will be given wherever feasible, but the Faculty reserves the right to require that candidates for re-admission take such subjects as it deems necessary in the construction of a sound program, even though the course material may have been previously studied. Since each individual case is different, no hard-and-fast rule can be laid down, but in general, credit will be given only when good or superior work has been demonstrated.

SPECIAL STUDENTS

Although most applicants for admission will wish to enroll for the full four-year degree program, a few persons may wish to take specialized work without regard for degree credit.

Special students usually are expected to conform to the general rules and regulations as specified by the Faculty. Their plan of study may not be of a nature as to deviate markedly from the regularly formulated subject matter and laboratory courses; and acceptance to special status is contingent upon the consent of the instructor in charge of each course to which admittance is sought.

The Committee admits only a few highly qualified students to special status each year. For detailed information concerning specific programs, applicants should communicate directly with the Director of Admissions.

Each year the Lowell Textile Institute regularly accepts for admission up to a maximum of 5% of the total number of students in any given class (freshman, sophomore, etc.) from foreign countries. There are no special procedures to be observed by foreign candidates, although it is urged that they endeavor to have the transcript of their secondary-school and/or college records, as well as all other admission materials, submitted in English, as early as possible in their final year of secondary school. All applicants should have a considerable facility in speaking and writing English, and have financial resources sufficient at least for their first year of study. Foreign students will be expected to complete the same schedule of courses as is assigned to all other students.

It is suggested, as noted above, that early arrangements be made with the College Entrance Examination Board to have a testing center located near the candidate's home. In all other respects, the admission procedures for foreign students are identical with those required of U. S. citizens.

ROOM ASSIGNMENTS

All Freshmen and Sophomores, except those who have received permission from the Dean of Students to live at home or in fraternity and rooming houses, are required to live in the residence halls. Rooms are adequately furnished and are cared for by the students occupying them. Each occupant is held responsible for any damage done to furniture and equipment.

Assignments of rooms in the residence halls are made through the Office of the Dean of Students. All assignments are for the full academic year. Change of room is not permitted except under unusual circumstances, and may be accomplished only after a formal application has been approved by the Dean of Students.

All rentals are uniform, the annual rate being $275.00 per year for each student.

Assignments of rooms are made as equitably as possible and in the order that applications are received. For those students who are unable to be placed in

residence halls, the Dean's Office supplies a list of approved rooming houses where students may reside. Where vacancies occur in the residence halls, students living in rooming houses may be required to relinquish these accommodations and to accept residence hall room assignments made by the Office of the Dean of Students.

ORIENTATION

Each freshman is expected to be in daily attendance beginning Wednesday, September 12, at 9:30 a.m., and to follow the prepared program which will be placed in his hands at that time. Late registration for all students at the Institute is subject to a five-dollar fine, unless accompanied by a medical or equally acceptable excuse.

Freshman Week — Freshman Week will be devoted to facilitating the adjustment of the beginning student to his new physical and social surroundings. Under the sponsorship of the Committee on Student-Faculty Relations a program of meetings, lectures, and conferences will be presented in order to acquaint the entering class with the traditions, customs, rules and regulations, courses of instruction, organizations, recreational and other facilities of the Lowell Textile Institute.

Faculty Advisers — During Freshman Week, each entering student will be assigned a member of the faculty who will serve as his faculty adviser for the next two years. The advisers function as a counseling link between the student and his academic and personal problems.

Effective Study Course — All new students at the Institute are required to take the course in Methods of Effective Study. It is of one semester's duration, with meetings scheduled once each week, and carries no credit. The course attempts to teach the student how to get the most out of his work at the Institute by efficient use of his time and talents.

GUIDANCE

A committee of faculty members supervises a guidance program which begins with the admission procedures, continues throughout the undergraduate years, and culminates in the work of the Placement Office.

Because living on-campus is an important aid in helping the new student adjust to college life, it is required that all freshman and sophomore students, except those who have permission to live at home or in fraternity houses, take residence in the dormitories.

Guidance in the freshman year stems mainly from the results of the admissions testing program, Freshman Week activities, the Effective Study course, and the work of the Faculty Advisers. These same advisers function throughout the sophomore year, but during the junior and senior years, the heads of departments and the Office of the Dean of Students take over primary responsibility for the students' personal and scholastic welfare.

The Office of the Dean of Students is open to all undergraduates at all times to assist the student in attaining his academic objective, and to assure his active, enjoyable participation in the work and affairs of the Institute.

The Placement Office functions as a natural outgrowth of the undergraduate guidance program. This office endeavors to keep Institute graduates in constant contact with the latest developments in the textile and allied industries, so that they may place themselves in positions best suited to their talents and abilities.

HEALTH SERVICE

The Dispensary, in Smith Hall, is in charge of a Registered Nurse eight hours each school day. She is on call 24 hours daily, including weekends. Students receive first aid treatment at the Dispensary, and are advised as to the best procedures in case of illness.

The College Physician is on call 24 hours daily. If any student requires hospitalization, the College Physician will arrange for admission to one of the three excellent, modern hospitals located in the immediate vicinity of the Institute. Medical fees and hospital charges are at the expense of the student.

Low-cost Group Accident and Sickness Insurance is also available to all students on a strictly voluntary basis.

STUDENT EXPENSES

The various student expenses described in this section apply only to the regular day school of Lowell Textile Institute. The fees and expenses of the Lowell Evening Textile School are described in a separate bulletin. All fees are established by the Board of Trustees and are subject to change without advance notice.

Payment of tuition and fees is an integral part of the registration process which must be completed before a student may attend classes. In certain special cases, the Bursar may authorize a delay in payment but all fees must be paid before any grades can be recorded by the Registrar on the student's permanent record. Requests for delay must be made to the Bursar in writing and approved by that office before the student's registration is complete.

Tuition — The yearly tuition fees are:

Residents of the Commonwealth of Massachusetts	$150
Non-residents	$250
Foreign students	$500

Students who are classified by the United States Immigration Authorities as "Displaced Persons" will pay non-residents' tuition of $250.

Special students pay, in general, the full tuition fee. However, if enrolled in only a limited number of courses, a special student may make application to the President for a reduction in tuition.

Students registering as residents of Massachusetts are required to file with the Bursar a certificate signed by either a town or city clerk, stating that the student's parents or guardian are legal residents of the Commonwealth.

The payment of one-half of the total yearly tuition will be made during the registration for each semester.

Activity Fee — Each student will pay, at his first registration for each academic year, an activity fee of $25.00. The payment of this fee entitles the student to free admission to all athletic events, a subscription to the student newspaper — The Text — and a copy of the yearbook — The Pickout. A portion of this fee helps to support the general student activities under the jurisdiction of the Student Council.

Residence Halls — All students, except those who live in Lowell or the surrounding community, may be required to live in one of the residence halls. The double rooms rent for $275 per student per year. One-half of the rent ($137.50) is payable at the start of each semester.

Deposits — Students taking chemistry make a deposit of $25 the first year, and $25 each term for the second, third and fourth year chemistry course; students taking machine shop are required to make a deposit of $10. All other students are required to make a deposit of $10 each year to cover any general breakage.

All deposits must be made before students can be admitted to laboratory work. The unexpended balance of any deposit will be returned at the end of the year to students not otherwise in arrears.

Late Registration Fee — Any student who does not complete his registration (including the payment of all fees) by the close of the registration period stated in the Institute calendar may be required to pay an additional fee of $5.00.

Books and Materials — Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement; but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments, or other property of the Institute loaned to the students are to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Tuition (residents of Massachusetts)	$150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Dormitory rate per year	275
Chemistry laboratory deposit (1st year)	25
Chemistry laboratory deposit (2d, 3d and 4th years)	50
Student activity fee	25
Machine shop deposit	10
General breakage fee (This applies to students who do not take chemistry or machine shop)	10
Books and supplies Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.)	50
Late registration fee	5

STUDENT SCHOLARSHIPS

SCHOLARSHIPS: — A limited number of scholarships is available to students of Lowell Textile Institute through funds contributed by various companies representing the textile or allied industry.

A. Administered by the Committee on Scholarships

1. *Chicopee Scholarships — sponsored by the Chicopee Manufacturing Corporation*

Two scholarships may be awarded annually to selected sophomores in the courses of Textile Engineering or Cotton Yarn Manufacturing. Each scholarship pays the recipient $600 per academic year for residents of Massachusetts or $700 per academic year for out-of-state residents and the awards are for each of the junior and senior years. Candidates must be native-born citizens of the United States with potentialities for both leadership and scholarship. Preference is given to natives of New England and the recipient is expected to work in an approved cotton mill during the summer periods.

2. *Fiberglas Scholarships — sponsored by the Owens-Corning Fiberglas Corporation*

This scholarship is awarded annually to an outstanding sophomore in any of the textile courses. It pays the recipient full tuition and $500 per academic year for each of the junior and senior years. Selection is based upon academic record, character, qualities of leadership, and need.

3. *Russell L. Brown Scholarship — donated by Davis and Furber Machine Company*

Open to a student acceptable to Lowell Textile Institute who plans to enroll in the curriculum of Textile Engineering or Wool Yarn Manufacturing. Preference given to employees and sons or grandsons of employees of Davis and Furber Machine Company. Selection based on general scholarship, initiative and need. Stipend $300. Appointments are for one year only but renewable.

Application should be filed with the Dean of Students not later than February first.

4. *Ralph E. Hale Scholarship of the Northern New England Section of the American Association of Textile Chemists and Colorists (1947).*

Established by the Northern New England Section of the American Association of Textile Chemists and Colorists in memory of Ralph E. Hale, 1951 Chairman-elect of the Section. This scholarship is awarded annually to a student at the completion of his or her junior year in the course in Chemistry, Textile Coloring and Finishing. The amount of the scholarship is $250 per year.

B. Administered by the agency designated

1. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Association make available several scholarships a year which cover tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

2. *Berkshire Fine Spinning Associates, Inc. Scholarships*

A number of scholarships covering tuition and living expenses for four years are offering in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employees of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

3. *The Gehring Foundation Memorial Scholarship — in memory of Henry G. Gehring and his son, Edward H. Gehring, both of whom were engaged in the Lace Industry.*

These scholarships are made possible as a result of the Gehring Memorial Foundation of New York, the James T. and Steven E. Smith Memorial Funds, the Warwick Chemical Foundation Scholarship Fund in memory of Walter Nowicki, and other scholarships presented and designated by various textile companies.

Application should be made through the Alumni Office, Lowell Textile Institute.

4. *Goodall-Sanford, Inc. Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Successful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

Application should be made to Goodall-Sanford, Inc., Scholarship Committee, Sanford, Maine.

5. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination to students who qualify for entrance to Lowell Textile Institute under the terms described in the ADMISSION section of this Bulletin. All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1952. Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

6. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Association selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

7. *United Elastic Corporation Scholarships*

Scholarships in the amount of $150 are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. Other residents of the communities where plants are located, however, may enter applications for consideration. Preference is given to native New Englanders and to those who agree to work summers in approved mills.

Qualifications for scholarships include: good character and standing in the community, aptitude for technical training, and ability to pass entrance requirements of Lowell Textile Institute and/or with the approval of the United Elastic Corporation and the Lowell Textile Institute, scholarships may be awarded to deserving upperclassmen.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following graduation.

All applications should be made through the plant nearest to residence of applicant. Plants are located at Easthampton, Lowell and Littleton, Massachusetts, West Haven, Connecticut, and Stuart, Virginia.

8. *Jacob Ziskind Memorial Scholarship*

Established by the employees of the Merrimack Manufacturing Company in memory of Jacob Ziskind.

Qualifications include: Good character, scholastic record, initiative and ability to pass the entrance examination at Lowell Textile Institute.

Preference in granting the scholarship will be given employees of the Merrimack Manufacturing Company or members of their immediate families residing in the Greater Lowell area. However, other residents of Greater Lowell may enter applications for consideration.

The Merrimack Manufacturing Company will, insofar as possible, provide suitable on-the-job training during the summer vacation period and following graduation.

The scholarship provides tuition, books, supplies and such deposits as are required to properly enroll the student in the course selected.

FELLOWSHIPS

A. Open only to graduates of Lowell Textile Institute

1. *Lowell Textile School Fellowship — sponsored by the Proprietors of the Locks and Canals on the Merrimack River.*

Pays tuition for graduate work at Massachusetts Institute of Technology.

2. *Textron Fellowship — sponsored by Textron, Inc.*

Annual stipend of $1800 to $2400. Recipient may elect to do graduate work or take one year of practical training in representative mills of the textile industry. Application should be made to the Scholarship Committee of Lowell Textile Institute.

B. Open to graduates of textile schools

1. *Chicopee Manufacturing Corporation Fellowship*

Stipend: $1200. For graduate work at Massachusetts Institute of Technology.

2. *Clark Thread Company Fellowship*

Stipend: $1200 and tuition. For graduate work at Massachusetts Institute of Technology.

3. *New England Textile Foundation Graduate Fellowship*

Stipend: $1000 plus tuition. For graduate work at Massachusetts Institute of Technology.

4. *Textron Fellowship*

Stipend: $1200. For graduate work at Massachusetts Institute of Technology.

Further information on these four fellowships is given in the catalog of Massachusetts Institute of Technology.

LOAN FUND

A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning six months after the date at which the student officially leaves school. Repayments are not required until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $5.00 per quarter the first year and $10.00 per quarter each year thereafter until the loan is repaid. Additional payments may be made at any time so as to reduce indebtedness at a more rapid rate.

STUDENT AWARDS

The following awards are given annually at Commencement:

1. *The Cotton Medal:* — given by the National Association of Cotton Manufacturers to that member of the graduating class in the courses of Textile Engineering (General Option) or Cotton Yarn Manufacture who has maintained the highest scholastic standing throughout the four years of his undergraduate work.

2. *Book Prize:* — given by the American Association of Textile Chemists and Colorists to the outstanding graduating senior in the course of Chemistry, Textile Coloring, and Finishing. The recipient is selected by the Chemistry Department and the academic standing of the candidates is an important factor. The award includes also a junior membership for one year in the A.A.T.C.C.

3. *Louis A. Olney Book Prizes:* — Selected reference books are awarded annually to the outstanding students in the course of Chemistry, Textile Coloring, and Finishing. The recipients are selected by the Department of Chemistry and the academic standing in the subjects of their major field for the past year is an important factor. The value of the prizes are:

Third year work	$20
Second year work	$15
First year work	$15

4. *Phi Psi Award:* — This award is given annually to an outstanding member of the graduating class in a Textile course on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

M.I.T.-L.T.I. COOPERATIVE PLAN

A cooperative plan of operation between these two institutions has been agreed upon. The major provisions include: (1) the mutual use of the facilities for research and manufacturing in Lowell Textile Institute and the Massachusetts Institute of Technology, Textile Division, for student theses, both graduate and undergraduate; (2) the mutual use of the textile libraries of both institutions; (3) the opportunity, open to students in each institution, to supplement their education by taking work available in the other; (4) the formation of joint seminars and the exchange of staff members for special lectures; and (5) frequent student visits and joint meetings of student societies.

STUDENT LIFE

Lowell Textile Institute believes that sound educational practice seeks to develop the whole personality of the student. Accordingly, Faculty and Administration encourage extra-curricular activities and support the development of a varied and well-rounded program of activities to supplement the purely academic phase of undergraduate life. This program provides opportunity for participation in formal and informal sports; in class and campus self-government; and in the many clubs and special interest activities which appeal to the varied interests of the student body.

ATHLETICS

Under the supervision of the President and the Faculty, the Athletic Association promotes an extensive varsity and intramural sports program. By virtue of their payment of the Student Activity Fee, all students are members of the Athletic Association and receive free admission to all intercollegiate contests played at home. Basketball and baseball teams compete with teams throughout the Northeast. Golf, soccer, lacrosse, and ski teams also compete regularly with other colleges.

Intra-mural sports are supervised by the Director of Intramural Athletics. This program includes both league and informal competition between the classes, residence halls, and the fraternities.

STUDENT GOVERNMENT

The Student Council is the chief body for the conduct of self-government in student affairs. It is composed of four officers elected at large by the student body, and the president and a representative elected by each of the four undergraduate classes.

By virtue of its function as chief governing body for student affairs, it exercises administrative control over all campus organizations organized under its supervision; represents the student body in matters requiring conference with the Administration and Faculty; investigates grievances submitted by students or student groups; sponsors all-campus dances, banquets, and other social affairs; and supervises the expenditure of the unallocated portion of the Student Activity Fee. It functions in accordance with the specific prescriptions of its Constitution and By-Laws.

SCHOLASTIC HONOR SOCIETY

Tau Epsilon Sigma is the scholastic honor society at Lowell Textile Institute. Election is open only to seniors who have been on the Dean's List for six consecutive semesters, or who have maintained a cumulative rating of 4.00 or higher for four years, without any failure.

CLUBS

The following clubs maintain a prominent position in the extra-curricular life of the campus:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. The Engineering Society
3. International Club — for foreign students
4. Rifle Club — which participates in intercollegiate matches.
5. Band

Newly arrived at the campus, and prepared for full activity in the fall of 1951 is the Newman Club. Other groups, less formal in organization, promote social, political, and intellectual activities for those interested in the particular areas covered by the groups.

DRAMATICS

The Textile Players constitute the center of all dramatic activities of the campus. For years, the annual productions of this group have been a high point in the social calendar of the Institute.

PUBLICATIONS

The TEXT is the campus newspaper. Prepared and edited by a student staff, this bi-weekly publication offers excellent journalistic and business experience to those who work on its staff.

The PICKOUT is the annual yearbook of the campus. Those who serve on the staff secure a valuable training in the editorial, art, and business problems involved in the production of a top-quality picto-literary history of an academic year. Supported by allotments from the Student Activity Fee.

GREEK LETTER SOCIETIES

Five Greek letter social groups have been granted official recognition by the Administration of Lowell Textile Institute.

The four fraternities, located in their own quarters, are as follows: Delta Kappa Phi, Omicron Pi, Phi Psi, and Pi Lambda Phi. The activities of these fraternities are co-ordinated through membership in the Interfraternity Council.

The sorority, Phi Sigma Rho, provides a center for the social life and mutual association of the young women studying at the Institute.

STUDENT RULES AND REGULATIONS

Students admitted to Lowell Textile Institute are assumed to be ladies and gentlemen, and of sufficient maturity and poise to enable them to live in an adult environment. Such living involves full respect for the rights of others, a regard for self-discipline and good order, and a high standard of honesty and of moral conduct.

In consequence of these assumptions, the regulations are framed not to restrict the conduct of individuals or groups of students, but, rather, to set forth the basic policies of the Faculty established in order that a large student body may live and work harmoniously together with a minimum of friction and misunderstanding. By the same token, even though the rules are neither detailed nor comprehensive, a student may be dropped from the rolls, or subjected to other disciplinary action, for conduct which is illegal, immoral, or inimical to the best interests of the Institute, regardless of whether or not the particular offense is listed in these rules and regulations.

ATTENDANCE

Attendance is expected of all students at all classes. The supervision of student attendance is lodged in the Office of the Dean of Students, both as to the announcement of detailed instructions, and as to the enforcement of the rules established by the Faculty. Students charged with unexcused absences, particularly absences immediately before and after holiday and vacation periods, are subject to disciplinary action.

DISCIPLINARY ACTION

Disciplinary action originates in the Office of the Dean of Students. Such action may be in the form of any of the following degrees of severity: Censure, Restriction, Suspension, or Dismissal. Whenever disciplinary action is taken, a notation of such action becomes a part of the permanent record of the student.

GRADES

Semester grades are reported by letter, as follows:

H 90–100, 5 points
C 80–89, 4 points
P 70–79, 3 points
L 60–69, 2 points
F 50–59, 1 point (condition — entitled to re-examination)
FF Below 50, failure (no credit unless subject is repeated)

The student's semester rating is a weighted value used to denote his relative standing. It is dependent upon the point value of his final grade and the credit hours allotted to the subject. To compute, the point value of the final grade is multiplied by the credit hours carried by the subject. The total of the calculated values is divided by the sum of the credit hours. The result is the student's semester rating. The cumulative rating covers two, or more, semesters, and is computed by the procedure followed in computing the rating for a single semester.

SCHOLASTIC REPORTS

Reports of scholastic standing are compiled regularly at the end of each semester. Unsatisfactory mid-semester grades are submitted to the office of the Dean of Students for guidance purposes, but formal notification of each student's status is made only at the conclusion of each semester.

DEAN'S LIST

The Dean's List is composed of those students who have a semester rating of 4.00 or higher, with no current failures.

PROBATION

A student is placed on probation when his semester rating is below 2.26. The probationary period covers the entire semester following the issuance of the semester rating which placed the student on probation.

A student who is on probation for two consecutive semesters will automatically be dropped.

A student on probation may not represent the Institute in any public function and may not hold class or other offices during his term of probation.

If a student receives a semester rating below 1.00, he may automatically be dropped from the Institute without benefit of a probationary period.

REQUIREMENTS FOR GRADUATION

Only those students who have satisfied the following minimum requirements will be recommended for the baccalaureate degree:

1. Successfully completed one of the curricula prescribed for this degree (see Pages 39 to 59) with a cumulative point average of at least 2.5;

2. No substitutions for subjects required to be taken in the major department;

3. Substitutions may be presented for subjects required in fields outside of the major department, provided such substitutions are approved by the Dean of Students, are in the same area of learning, require an equivalent amount of time for their completion, and, if not taken at the Institute, the credit is acceptable to the Registrar's Office and the Department Head concerned. For this purpose, the Registrar will not accept transfer credit when the grades are less than P, nor include such transfer credits when calculating the cumulative average.

PLACEMENT OFFICE

The Institute maintains a central placement office which has three functions:

1. To assist in the placement of graduating students.

2. To assist in the up-grading of alumni and/or to help each alumnus attain a position yielding a maximum of satisfactory and happiness.

3. To assist industry in the increasingly difficult job of locating trained and experienced personnel.

The Placement Office is concerned solely with positions affecting the graduating student; it does not attempt to place undergraduates in part-time or summer employment.

4. Administration of the Co-operative Education Plan.

THE CO-OPERATIVE EDUCATION PLAN

In 1948, Lowell Textile Institute, formally adopted the Co-operative Plan of Education, on a voluntary basis, wherein those students who elect the plan, and who pass the competitive selection process successfully, spend three summers in the textile industry on a planned work-study basis.

Work opportunities are available to a limited number of students, beginning at the end of the freshman year and continuing each summer thereafter until graduation. It is the aim of this program to give to participating students certain educational experiences that cannot be obtained in school and yet which are vital to the background of the technically trained college graduate, such as contact with machines and people in a production environment; development of an awareness of jobs and the impact of mass production methods on the personality of labor; knowledge of the interplay of the different fields of study covered in school in the successful operation of business. It is also hoped that by working in the industry early enough in his career, the student can judge more clearly and more thoughtfully whether or not he has been wise in choosing a textile career.

This group meets informally throughout the year to discuss work experiences and to hear lectures by leaders in the textile industry.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry, Master of Science in Textile Engineering, and Master of Science in Textile Manufacturing to graduate students who satisfactorily complete a program of advanced standing. Recently, authority has been granted to include Master of Science work in the fields of Paper Engineering and of Leather Engineering which will lead to corresponding degrees.

The object of these programs is to offer to properly qualified graduates of the Institute who hold bachelor degrees an opportunity to pursue advanced courses in their undergraduate field, supplemented by work in other departments. It is also the object to offer to properly qualified graduates holding bachelor degrees from other institutions of higher learning an opportunity to carry on courses in textile education that will prepare them for entrance into the textile industry.

I. General Admission

An applicant for admission as a Graduate Student must present evidence that he is the holder of a Bachelor's degree in an acceptable four-year course in the pursuance of which he maintained a uniformly high scholastic rating. He must also be prepared to submit statements, from persons qualified to judge, that in their opinion he has the ability to pursue graduate work. *Applications for admission to the Graduate School should be made to the Registrar and filed no later than April 15.*

II. As a Provisional Graduate Student

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfies the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a Graduate Student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 3.5 (80%).

III. Requirements for Graduation

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

a. Completed a course of study approved by the department in which he has been enrolled.

b. Completed a thesis (original research or other investigation, optional with department) approved by the department in which he has been enrolled.

c. Residence of at least one academic year.

d. An average rating of 3.5 (80%) in those subjects submitted for graduate credit. Those subjects submitted for graduate credit, which are normally upper-class undergraduate subjects (those offered to juniors and/or senior students) must be passed with a grade of 80% or better.

The exact nature of each student's program will be worked out in co-operation with the major professor and approved by the Head of Department. Every attempt will be made to keep such programs flexible and in keeping with the student's educational objectives.

A graduate of Lowell Textile Institute, or one with equivalent training, can usually complete the work for the Master's degree in one year, provided he continues his major studies in the same field in which he majored as an undergraduate. Other students, or those who change their educational emphasis, will require a longer time, usually two years, according to the number of prerequisite subjects which must be taken.

Special work may be done in the Graduate School, by arrangement with the Graduate School Committee, by individuals not seeking an advanced degree, but who wish to take special subjects or to conduct research to which the facilities at Lowell Textile Institute may be peculiarly adapted. Candidates seeking such status must meet the requirements for General Admission to the Graduate School, as noted above.

Southwick Hall

Engineering Drawing

COURSES FOR THE BACHELOR OF SCIENCE DEGREE

SPECIAL ANNOUNCEMENT

The Secretary of Defense for Air announced on April 20, 1951 that an Air Force Reserve Officers' Training Corps unit will be established at Lowell Textile Institute. The instruction will begin with the opening of the first semester in September 1951.

The information was received too late for the details to be included in this issue of the catalog but the ROTC program will be integrated with all curricula. Details of the changes in curricula will be announced soon and the changes will be effective September 1, 1951.

See special announcement on Page 4 for further details.

Lowell Textile Institute offers ten curricula options, all leading toward the B.S. degree. A student chooses the desired option at the conclusion of the first semester of the freshman year and begins to specialize during the second semester of the freshman year. All curricula are sufficiently broad in educational scope during the first two years to permit a student to alter his initial choice of curriculum with a minimum of lost time, should a new objective become desirable.

A detailed program of each of these curricula is given in tabular form on the following pages. Shown for each semester are the subjects required; the lecture-recitation and laboratory hours and the credit toward graduation assigned to each subject; and the totals of both the credits and contact hourse per week. In general, one credit represents one hour of lecture-recitation work or approximately three hours of laboratory work. A more detailed description of each subject offered at Lowell Textile Institute may be found in the section of this Bulletin entitled "SUBJECT DESCRIPTIONS", wherein the subject fields are listed alphabetically and may be found by referring to the same subject number designations shown in the tables below.

First Year. First Semester (Common to All Courses)

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	4-3	5
Eng.	111	Engineering Drawing	0-6	2
Engl.	101	English Composition and Literature	3-0	3
Math.	101	College Mathematics	4-0	4
Phys.	101	Physics	4-1	4½
Tex.	101	Survey of Textiles	2-0	1
		or		
Lea.	101	Survey of Leather	1-0	0
		or		
Paper	101	Survey of Paper	1-0	0
		Physical Education	0-2	0
			28-29	18½-19½

COURSE I—COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or of textiles produced from any staple fiber utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to process rayon, wool, and other staple fibers is considered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

Laboratory work consists of series of experiments planned to give the student a good acquaintance with the equipment and how it is used for spinning, weaving and finishing cotton materials. Most of the laboratory equipment is full sized commercial machinery such as the graduate will meet in his industrial experience. Laboratory work is generally synchronized with the lectures to demonstrate and supplement lecture instruction.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cotton	201-202	Cotton Carding	3-6	5	3-6	5
Cotton	211	Cottons	1-1	1½	—	—
Cotton	222	Cotton Waste Processing	—	—	1-1	1½
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Des.	262	Color	—	—	1-1	1
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	211-212	Weaving	2-2	2½	2-2	2½
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	—	—	3-0	3
			29	21	28	19

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chem.	2-0	2	1-3	2
Cotton	301	Cotton Spinning	2-5	4	—	—
Cotton	302	Cot. Winding and Twisting .	—	—	2-10	5
Cotton	311	Staple Fiber Manufacture .	1-1	1½	—	—
Cotton	322	Cotton Quality Control. .	—	—	1-0	1
Des.	223	Fabric Design and Analysis .	2-1	2	—	—
Eco.	201-202	Economics	3-0	3	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing . . .	2-2	3	2-2	3
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
			29	21	30	18½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cotton	401	Mill Organization	4-0	4	—	—
Cotton	402	Management Problems . .	—	—	2-0	2
Eco.	351	Textile Marketing . . .	2-0	2	—	—
Eco.	412	Industrial Management .	—	—	4-0	4
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English . . .	—	—	1-0	1
Finish	421-422	Cotton and Synthetic Fin. .	2-3	3	2-3	3
Knit.	401	Knitting	2-5	4	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Elective	. . . .		3 to 12	3-4	3 to 9	2-3
			24-33	19-20	21-28	18½-19½

COURSE II — WOOL MANUFACTURE

The course in Wool Manufacturing is planned for students who contemplate a career in the industries utilizing the wool fiber, or using the woolen, worsted, or felt systems of machinery to process fibers of any type. The student studies all fibers and all basic processing systems, but emphasis is given to the wool fiber and its manufacture.

The purpose of the Wool Manufacturing course is to train students for executive positions in any of the branches of the wool industry. It is planned for those who are chiefly interested in the production and processing phases. A thorough engineering and scientific background is part of the course in order to enable the student to better understand the application of engineering principles as applied to both textile machines and processes.

A maximum amount of time is devoted to the professional or textile subjects. Laboratory experiments are planned to train the student in the method of analyzing machines, as well as tests, settings, adjustments and the elimination of faulty work. With wool now being manufactured on cotton machinery, a study in Survey of Cotton Manufacture is offered in order that the student may know the similarities and differences of the wool and cotton systems. Synthetic fiber processing in the woolen and worsted systems is studied and laboratory work includes the actual processing of staple rayon and other manufactured fibers alone or blended with wool. Courses in Economics, Speech, Business Administration, Labor Problems, etc. are offered to better prepare the student to assume a position of responsibility and leadership, both in the industry and in his community.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	232	Fablic Design and Analysis	—	—	2-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Eng.	212	Heat and Power	—	—	2-2	3
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	211-212	Weaving	2-2	2½	2-2	2½
Wool	211-212	Top Making	2-6	5	2-6	5
Engl.	222	Appreciation of Literature or				
Soc. Sci.	212	World History	—	—	3-0	3
			29	22½	30	22½

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Cot.	331	Cotton Yarn Manuf. Survey	3-1	3	—	—
Des.	233	Fabric Design and Analysis	2-1	2	—	—
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Texting	2-2	3	2-2	3
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Wool	301-302	Woolen Yarns	2-4	3½	2-4	3½
Wool	321-322	Worsted Yarns	3-3	4	3-5	5
			29	20	28	18

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Des.	271	Accounting and Costing	3-0	3	—	—
Eco.	343	Industrial Management	—	—	4-0	4
Eco.	351	Tex. Process Instrumentation	—	—	0-2	2
Eco.	412	Speech	2-0	2	—	—
Eng.	422	Business English	1-0	1	—	—
Engl.	201	Wool and Worsted Finishing	2-3	3	2-3	3
Engl.	211	Knitting	2-5	4	—	—
Fin.	401-402	Modern Economic Problems	3-0	3	—	—
Knit.	401	Modern Labor Problems	—	—	3-0	3
Soc. Sci.	301	Filament Yarn Processing Survey	—	—	2-0	1½
Soc. Sci.	302	Woolen and Worsted Mill Organization	—	—	4-0	4
Syn.	322	Text. Marketing	2-0	2	—	—
Wool	412	Color	1-1	1	—	—
Electives			—	—	3-9	3
			25	19	23-29	20½

COURSE III — TEXTILE DESIGN

The prescribed curriculum of the Textile Design Course is especially planned to equip the student with the fundamentals of structural textile design. This type of designing of textiles is concerned with the building of a fabric. To this end the student should become fully conversant, through lectures and laboratory work, with the properties of natural and synthetic fibers; the different systems of yarn manufacture; various arrangements of yarns in fabrics; the methods used to execute designs in woven and knitted fabric; dyeing; the various finishing processes employed after fabrication; and, the methods used for testing fabrics.

Emphasis is placed on subjects dealing with the analysis and designing of fabric structures, from the simplest plain fabric to the more complicated and elaborate. Such subjects as color, perspective, freehand drawing, and decorative design are included to extend somewhat the structural design thinking toward artistic expression in fabrics. The broad scope of this curriculum provides, in addition to the more specific structural design objectives, subjects in the sciences, liberal arts, and management.

The graduate of the Textile Design Course, though more specifically equipped as a structural textile designer, is qualified to enter into other branches of the textile industry according to his aptitudes and opportunities.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Des.	102	Elementary Textile Design	2-1	2
Des.	104	Yarn Calculation	1-0	1
Des.	112	Handloom Weaving	0-3	1
Des.	122	Perspective	0-2	1
Des.	132	Freehand Drawing	0-2	1
Eng.	104	Mechanism	2-0	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Des.	203-204	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	211-212	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	242	Decorative Design	—	—	0-2	1
Des.	251-252	Color	1-1	2	1-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	201-202	Weaving	2-4	3½	2-4	3½
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	—	—	3-0	3
			29	23½	29	22½

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Des.	301-302	Textile Design & Fabric Analysis	2-2	3	2-2	3
Des.	311-312	Textile Design & Fabric Analysis	2-2	3	2-2	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	301-302	Weaving	2-4	3½	2-4	3½
Wool	312	Survey of Wool Manufacture	—	—	3-1	3
			24	17½	30	21

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Des.	401	Leno Fabric Design and Analysis	1-1	1½	—	—
Des.	402	Advanced Textile Design and Analysis	—	—	1-2	2
Des.	411-412	Jacquard Design and Weaving	1-2	2	1-2	2
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Knit.	403	Knitting	2-3	3	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Elective			3 to 9	3	—	—
			27-33	21½	22	18

COURSE IV — CHEMISTRY, TEXTILE COLORING AND FINISHING

This curriculum is designed to train those who wish to engage in the bleaching, scouring, dyeing, printing and finishing of textiles, or who are interested in the manufacture, demonstration and sale of dyestuffs, detergents and other chemicals used in the textile industry. Students having difficulty in color perception, while unfitted for employment in dyehouses or with dyestuff concerns, are capable of having a successful career in other branches of Textile Chemistry.

This course provides a basic training in chemistry, physics and mathematics. To this is added theoretical and practical training in bleaching, dyeing, printing and finishing, given in the junior and senior years. Since it is assumed that the students will eventually have executive or supervisory positions, they are required to take courses in English and Speech to provide a background for report writing and the expression of ideas. Courses in the humanities are also required in the hope that with a broader training the graduate will become a more valuable member of his community as well as a success in his chosen profession. German is offered students intending to study for advanced degrees.

This course leads to the degree of Bachelor of Science in Textile Chemistry.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	104	General Inorganic Chemistry	3-0	3
Chem.	122	Qualitative Analysis	3-6	5
Chem.	124	Elementary Stoichiometry	2-0	2
Eng.	104	Mechanism	2-0	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			27	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chmeistry	3-3	4	3-3	4
Chem.	204	Chem. Tchnology of Fibers	—	—	2-0	2
Chem.	211-212	Quantitative Analysis	1-6	3	1-6	3
Chem.	231	Library	1-0	1	—	—
Chem.	241-242	Stoichiometry	1-0	1	1-0	1
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Engl.	211	Business English	1-0	1	—	—
Math.	203-204	Mathematics for Chemists	4-0	4	2-0	2
Phys.	201-202	Physics	3-2	4	3-2	4
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Wool	312	Survey of Wool Manufacture	—	—	3-1	3
			29	21	29	20½

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	311	Textile Quantitative Anal.	1-6	3	—	—
Chem.	321-322	Textile Chemistry	2-3	3	2-3	3
Chem.	331-332	Physical Chemistry	3-1½	3½	3-3	4
Chem.	362	General Colloid Chemistry	—	—	2-0	2
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Eco.	201-202	Economics	3-0	3	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Restricted Electives*						
Chem.	312	Textile Quantitative Analysis or	—	—	1-3	2
Chem.	342	Organic Qualitative Analysis				
Chem.	352	Chemical Enginering or	—	—	3-0	3
Ger.	202	Technical German				
Eng.	351	Experimental Applications of Statistics or	3-0	3	—	—
Ger.	201	Technical German				
			30½	21½	29	22

*If German is elected during the first semester, it must be continued throughout the year.

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	411-412	Advanced Textile Chemistry and Dyeing	2-9	5	2-9	5
Chem.	422	Advanced Chemical Textile Testing	—	—	2-3	3
Chem.	431	Macromolecular Chemistry of Textile Processes	2-0	2	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Engl.	202	Speech	2-0	2	—	—
Fin.	411	Woolen and Worsted Fin.	3-3	4	—	—
Fin.	432	Cotton and Synthetic Fin.	—	—	3-3	4
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Eco.	344	Principles of Selling and Advertising				
or		or	—	—	4-0	4
Eco.	412	Industrial Management				
Professional Electives			1 or 3	2	1 or 3	2
			27 or 29	20	30 or 32	21

COURSE V — SYNTHETIC TEXTILES

This curriculum is designed for students interested in those segments of the textile industry primarily devoted to the utilization of man-made fibers, with particular emphasis on continuous filament fibers. Silk, being a natural continuous filament fiber not covered in other manufacturing courses, is also considered.

The synthetic fiber phase of textiles is the most recent addition to the industry and found its origin in the various chemical research laboratories. Because of this, an understanding of the manufacture and utilization of synthetic fibers depends upon a sound training in chemistry, physics and mathematics. More emphasis is placed on chemistry than in the other manufacturing courses.

Realizing the importance of a broad college training for men entering the industry with the intention of eventually assuming some type of administrative position, specialization in textiles is limited to approximately forty percent of the total credit hour load. The remaining sixty percent of the studies are devoted to basic subjects, such as the fundamental physical sciences, English, the social sciences and economics. Within the broad field of specialization in textiles, about one-half of the time is devoted to synthetic fibers, yarns and textiles.

Graduates of this curriculum should be acceptable to the textile manufacturer, the synthetic fiber producer, and the graduate schools of the country.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Syn.	102	Orientation in Synthetic Textiles	1-0	1
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			31	21

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Cot.	332	Cotton Yarn Manufacture Survey	—	—	3-1	3
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History	—	—	3-0	3
			27	22	27	22

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Des.	303	Synthetic Fabric Design & Analysis	1-2	2	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Soc. Sci.	221	Economic History	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Syn.	301	Filament Yarn Processing	2-0	2	—	—
Syn.	302	Throwing Plant Organization	—	—	2-0	2
Syn.	311	Manufacture of Synthetic Fibers	3-0	3	—	—
Syn.	312	Structure and Properties of Synthetic Fibers	—	—	3-0	3
Syn.	331-332	Filament Yarn Laboratory	0-3	1	0-3	1
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	211-212	Weaving	2-2	2½	2-2	2½
			26	20½	25	18½

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Fin.	432	Cotton & Synthetic Finishing	—	—	3-3	4
Knit.	403	Knitting	2-3	3	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	402	Industrial Relations Seminar	—	—	2-0	2
Syn.	411-412	Properties and Applications of Synthetic Fibers	3-0	3	3-0	3
Syn.	452	Synthetic Textiles Seminar	—	—	2-0	2
Weav.	311-312	Weaving	2-2	2½	2-2	2½
Free Electives			5 to 15	5	2 to 6	2
			23-33	19½	23-27	19½

COURSE VI — TEXTILE ENGINEERING

The concept of a textile engineer originated in 1905, and the first known curriculum in Textile Engineering appears in the Lowell Textile Institute catalog for 1905–06. Through the succeeding years the same general pattern has been followed in this training, modified from time to time, however, to recognize changing conditions in the industry and in educational ideas, but always embodying the same two fundamental foundations. A textile engineer is defined as one who has had a basic training in engineering to which has been added a thorough grounding in the manufacture of textiles, their properties and uses.

Two options are offered in Textile Engineering, viz., Engineering and General Manufacturing. It is the belief of the Engineering faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, e.g., chemistry, the ideal training for the textile industry combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, as well as an orientation to society and business through a selected core of liberal arts and economics subjects. Although the credit hour ratings, assigned to VI-E and VI-G are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

ENGINEERING OPTION — VI-E

The Engineering Option provides a training in Mechanical Engineering similar to that found in other engineering schools. To this is added a knowledge of Textiles sufficient to prepare the individual for positions in the textile and allied industries which may involve research and engineering principles. Business subjects and the humanities are included in the curriculum so that this type of textile engineer may have the educational potential to rise to a position of executive responsibility.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	332	Cotton Yarn Manufacture Survey	—	—	3-1	3
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	224	Fabric Design and Analysis	—	—	2-1	2
Des.	234	Fabric Design and Analysis	—	—	2-1	2
Eng.	201	Machine Drawing	0-3	1	—	—
Eng.	221	Textile Mechanism	1-2	1½	—	—
Eng.	222	Applied Mechanics	—	—	3-0	3
Eng.	233	Machine Tool Laboratory	0-3	1	—	—
Engl.	201	Speech	2-0	2	—	—

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Engl.	212	Business English . . .	—	—	1-0	1
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phy.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl. or Soc. Sci.	222 or 212	Appreciation of Literature or World History . . .	—	—	3-0	3
			28	19½	25	21

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eco.	201-202	Economics	3-0	3	3-0	3
Eng.	301-302	Advanced Applied Mechanics	3-0	3	3-0	3
Eng.	312	Heat Engineering . . .	—	—	3-2	4
Eng.	331	Mill Engineering . . .	3-0	3	—	—
Eng.	342	Principles of Electrical Engineering . . .	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Phys.	321	Electronics	3-2	4	—	—
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing . . .	2-2	3	2-2	3
Weav.	333-334	Weaving	1-2	1½	1-2	1½
			24	20½	27	22

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eco.	343	Accounting and Costing .	3-0	3	—	—
Eco.	412	Industrial Management .	—	—	4-0	4
Eng.	401	Principles of Electrical Engineering . . .	3-2	4	—	—
Eng.	402	Textile Applications of Electricity	—	—	2-3	1
Eng.	411	Advanced Heat Engineering	2-2	3	—	—
Eng.	421	Engineering Design of Textile Structures . .	2-0	2	—	—
Eng.	422	Textile Process Instrumentation	—	—	2-0	2
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Knit.	404	Knitting	—	—	2-3	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Eng.	431	Advanced Physical Testing				
or		or	1-3	2	—	—
Phys.	401	Advanced Textile Microscopy				
Eng.	424	Machine Design . . .			2-2	
or		or	—	—		3
Phys.	402	Advanced Textile Physics			2-3	
or		or				
Math.	402	Differential Equations			3-0	
			27	21	28-30	20

GENERAL MANUFACTURING OPTION — VI-G

The objective of the General Manufacturing Option is to provide the textile industry with technically trained textile engineers. The curriculum has been planned so that the textile engineer (1) shall be given as complete and thorough a knowledge and understanding of the raw materials, machines, and processes peculiar to the manufacture of all fibers as is possible; (2) shall have a basic training in mechanical engineering, and the fundamental sciences and (3) shall acquire a knowledge of business principles and the social sciences.

The first objective should prepare the student to be useful in any textile plant regardless of fiber processed. The second should develop a man who will approach textile problems from an engineering viewpoint thus contributing toward their solution the benefits of a trained analytical mind. The third objective should aid in the production of a well rounded individual.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry . . .	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Engl.	102	English Composition and Literature .	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Cot.	203-204	Cotton Carding . . .	3-2	4	3-2	4
Des.	101	Elementary Textile Design .	2-1	2	—	—
Des.	103	Yarn Calculation . . .	1-0	1	—	—
Des.	224	Fabric Design and Analysis .	—	—	2-1	2
Des.	234	Fabric Design and Analysis .	—	—	2-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
Tex.	241	Library	1-0	1	—	—
Weav.	221-222	Weaving	2-0	1½	2-0	1½
Wool	215-216	Top Making	2-2	3	2-2	3
			27	22½	28	22½

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Cot.	303	Cotton Spinning	2-2	3	—	—
Cot.	304	Cotton Winding and Twisting	—	—	2-2	3
Eng.	321	Strength of Materials	3-0	3	—	—
Eng.	344	Electrical Machinery	—	—	3-2	4
Phys.	321	Electronics	3-1	3½	—	—
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	321-322	Weaving	2-0	1½	2-0	1½
Wool	323-324	Woolen Yarns	2-2	2½	2-2	2½
Wool	325-326	Worsted Yarns	3-2	3½	3-2	3½
			28	22	30	21½

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Cot.	401	Mill Organization	4-0	4	—	—
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	351	Textile Marketing	2-0	2	—	—
Eco.	412	Industrial Management	—	—	4-0	4
Eng.	311	Principles of Heat Engineering	3-2	4	—	—
Eng.	402	Textile Applications of Electricity	—	—	2-3	1
Eng.	422	Textile Process Instrumentation	—	—	2-0	2
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Knit.	404	Knitting	—	—	2-2	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Eng. or Phys.	431 401	Advanced Physical Testing or Advanced Textile Microscopy	1-3	2	—	—
			27	22	29	21½

COURSE VII — TEXTILE SALES

This course is designed for those interested in the marketing and merchandising of textile and allied products. Its emphasis is on training in all phases of management, particularly as applied to the distribution of textiles. In addition, the student is given a fundamental knowledge of the natural sciences and their application to the processing of all types of textile fibers. This scientific and manufacturing background is increasingly essential to effective selling, merchandising and management of distribution, particularly at the higher levels of supervision. A substantial amount of time is also devoted to cultural subjects designed to broaden the student's outlook, increase his understanding of social and economic problems, and improve his ability to get along with people.

This course leads to the degree of Bachelor of Science in Textile Manufacturing.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Eng.	102	Mechanism	4-0	4
Eng.	112	Engineering Drawing	0-6	2
Eng.	122	Machine Tool Laboratory	1-2	1
Eng.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
Tex.	102	Introduction to Fibers	2-0	2
		Physical Education	0-2	0
			30	20

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	221-222	Introduction to Textile Chemistry	2-0	2	1-3	2
Des.	101	Elementary Textile Design	2-1	2	—	—
Des.	103	Yarn Calculation	1-0	1	—	—
Des.	222	Fabric Design and Analysis	—	—	2-1	2
Des.	251-252	Color	1-1	2	1-1	2
Eco.	201-202	Economics	3-0	3	3-0	3
Math.	205	Mathematics	4-0	4	—	—
Phys.	201-202	Physics	3-2	4	3-2	4
Soc. Sci.	222	Man and his Environment	—	—	3-0	3
Syn.	322	Filament Yarn Processing Survey	—	—	2-0	1½
Tex.	241	Library	1-0	1	—	—
Wool	311	Survey of Wool Manufacture	3-1	3	—	—
Engl.	222	Appreciation of Literature or				
Soc. Sci.	212	World History	—	—	3-0	3
			25	22	25	20½

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Cot.	331	Cotton Yarn Manufacture Survey	3-1	3	—	—
Des.	223	Fabric Design and Analysis	2-1	2	—	—
Des.	232	Fabric Design and Analysis	—	—	2-1	2
Eco.	311	Economic Statistics	3-0	3	—	—
Eco.	321-322	Principles of Marketing	3-0	3	3-0	3
Eco.	344	Principles of Selling & Advertising	—	—	4-0	4
Engl.	201	Speech	2-0	2	—	—
Engl.	212	Business English	—	—	1-0	1
Soc. Sci.	311	Psychology	3-0	3	—	—
Soc. Sci.	312	Sociology	—	—	3-0	3
Tex.	302	Fabrics	—	—	2-0	2
Tex.	311-312	Textile Testing	2-2	3	2-2	3
Weav.	333-334	Weaving	1-2	1½	1-2	1½
			25	20½	23	19½

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Des.	233	Fabric Design and Analysis	2-1	2	—	—
Eco.	341-342	Principles of Accounting	3-0	3	3-0	3
Eco.	412	Industrial Management	—	—	4-0	4
Eco.	421	Foreign Trade	3-0	3	—	—
Eco.	431-432	Selling Policies	3-0	3	3-0	3
Fin.	412	Woolen and Worsted Finishing	—	—	3-3	4
Fin.	431	Cotton and Synthetic Finishing	3-3	4	—	—
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
Soc. Sci.	302	Modern Labor Problems	—	—	3-0	3
Electives			2-4	2-3	4-6	3-4
			23-25	20-21	23-25	20-21

COURSE VIII — PAPER ENGINEERING

The object of this course is to fit a man for work in the paper making, paper converting or allied industries. For this a thorough training in basic chemical engineering is offered, accompanied by instruction in the theory and practice of pulp and paper manufacture and paper converting. Paper engineering involves the application of cellulose and plastics chemistry together with engineering principles to the handling of the material in the web or sheet form, as it is treated, coated or converted into the final product. Every effort will be made by cooperation with local concerns to supplement college work by experience in actual manufacturing conditions, thus giving the student an opportunity to familiarize himself with equipment commonly in use in the industry.

Students taking this course should be well equipped for work in the paper making or paper converting fields or for graduate study in paper technology.

The curriculum outlined below should be regarded as provisional in character.

This course leads to the degree of Bachelor of Science in Paper Engineering.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	102	General Inorganic Chemistry	3-3	4
Chem.	112	Qualitative Analysis	2-3	3
Chem.	124	Elementary Stoichiometry	2-0	2
Eng.	112	Engineering Drawing	0-6	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
		Physical Education	0-2	0
			28	18

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Chem.	213	Quantitative Analysis	2-6	4	—	—
Chem.	231	Library	1-0	1	—	—
Eng.	104	Mechanism	—	—	2-0	2
Eng.	122	Machine Tool Lab.	—	—	1-2	1
Engl.	202	Speech	—	—	2-0	2
Engl.	212	Business English	—	—	1-0	1
Math.	203-204	Mathematics for Chemists	4-0	4	2-0	2
Paper	201-202	Pulp and Paper Manufacture	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
			27	20	24	19

Third Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	331-332	Physical Chemistry . .	3-1½	3½	3-3	4
Chem.	333	Industrial Stoichiometry .	3-0	3	—	—
Chem.	352	Chemical Engineering . .	—	—	3-0	3
Chem.	362	General Colloid Chemistry .	—	—	2-0	2
Eng.	342	Principles of Electrical Engineering	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Paper	302	Pulp and Paper Manufacture	—	—	3-0	3
Paper	303	Wood Technology . .	3-3	4	—	—
Paper	312	Pulp and Paper Testing and Analysis	—	—	4-7	6
Phys.	321	Electronics	3-1	3½	—	—
Soc. Sci.	221	Economic History . .	3-0	3	—	—
			23½	20	27	19

Fourth Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	442	Advanced Chemical Engineering	—	—	3-0	3
Eng.	401	Principles of Electrical Engineering	—	—	3-2	4
Paper	401	Practical Work in Industry .	—	18	—	—
Paper	403	Materials of Construction Corrosion	—	2	—	—
Paper	404	Paper Coating and Converting	—	—	3-0	3
Paper	412	Industrial Cellulose Esters .	—	—	1-0	1
Paper	414	Advanced Paper Problems .	—	—	2-6	4
Soc. Sci.	302	Modern Labor Problems .	—	—	3-0	3
			—	20	23	18

COURSE IX — LEATHER ENGINEERING

The concept of a leather engineer is new to the leather industry. The economic size of this industry as well as the scope and number of its problems warrants the careful training of individuals capable of handling the specific problems which arise in this industry. The leather industry realizes that many of its products can be improved by the application of sound and intelligent research and development. The demand is growing for engineers having a basic understanding of the art of leather manufacturing.

In this curriculum, emphasis will be placed on the fundamentals of engineering, including mathematics, physics, chemistry and theoretical and applied mechanics. These subjects are basic in any sound undergraduate program. Since the undergraduate student cannot be left with a great collection of tools which he does not understand, subjects are offered in the application of these basic scientific principles to leather technology. In order to properly balance this program, subjects in general education are offered, since the engineer as well as being trained to be a leader in his profession must also be trained to be a leader in the everyday economic, social and political affairs. He must also be trained to meet success, promotion and the challenge of directing the work of others.

The curriculum outlined below should be regarded as provisional in character.

This course leads to the degree of Bachelor of Science in Leather Engineering.

First Year — Second Semester

			Contact Hours	Credit Hours
Chem.	104	General Inorganic Chemistry	3-0	3
Chem.	112	Qualitative Analysis	2-3	3
Chem.	124	Elementary Stoichiometry	2-0	2
Eng.	104	Mechanism	2-0	2
Eng.	112	Engineering Drawing	0-6	2
Engl.	102	English Composition and Literature	3-0	3
Math.	102	College Mathematics	4-0	4
		Physical Education	0-2	0
			27	19

Second Year

			First Semester Cont. Hrs.	First Semester Cr. Hrs.	Second Semester Cont. Hrs.	Second Semester Cr. Hrs.
Chem.	201-202	Organic Chemistry	3-3	4	3-3	4
Chem.	213	Quantitative Analysis	2-6	4	—	—
Eng.	201	Machine Drawing	0-3	1	—	—
Eng.	222	Applied Mechanics	—	—	3-0	3
Engl.	201	Speech	2-0	2	—	—
Engl.	212	Business English	—	—	1-0	1
Ger.	201-202	German	3-0	3	3-0	3
Lea.	202	Applied Leather Analysis	—	—	1-6	3
Math.	201-202	Analytic Geometry and Calculus	3-0	3	3-0	3
Phys.	201-202	Physics	3-2	4	3-2	4
			30	21	28	21

Third Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Chem.	331-332	Physical Chemistry	3-1½	3½	3-3	4
Chem.	335	Chemistry of the Proteins	3-0	3	—	—
Chem.	362	General Colloid Chemistry	—	—	2-0	2
Eco.	412	Industrial Management	—	—	4-0	4
Eng.	321	Strength of Materials	3-0	3	—	—
Lea.	301-302	Leather Manufacture	3-6	5	3-6	5
Lea.	303	Histo-Pathology of Animal Tissues	1-6	3	—	—
Lea.	304	Microscopy in Tanning	—	—	1-3	2
Lea.	322	Tanning Mechanisms	—	—	3-0	3
Soc. Sci.	301	Modern Economic Problems	3-0	3	—	—
			29½	20½	28	20

Fourth Year

			First Semester Cont. Hrs.	Cr. Hrs.	Second Semester Cont. Hrs.	Cr. Hrs.
Eco.	343	Accounting and Costing	3-0	3	—	—
Eco.	468	Corporation Finance	—	—	3-0	3
Eng.	344	Electrical Machinery	—	—	3-2	4
Eng.	351	Experimental Applications of Statistics	3-0	3	—	—
Eng.	424	Machine Design	—	—	2-2	3
Lea.	401-402	Leather Manufacture	3-6	5	3-6	5
Lea.	404	Properties of Leather	—	—	2-3	3
Lea.	411-412	Leather Problems	1-6	3	1-6	3
Phys.	321	Electronics	3-1	3½	—	—
Soc. Sci.	463	Business Law	3-0	3	—	—
			29	20½	33	21

SUBJECT DESCRIPTIONS

1. First semester subjects are those ending in odd numbers.
2. Second semester courses are indicated by even numbers.
3. Subjects continuing throughout the year are indicated by hyphenated numbers.
4. The number of lecture-recitation and laboratory hours is indicated within the parentheses and the credit is shown outside. In the case of a year course, the credit shown is the total for the year. Example: (2-6)4 would mean 2 hours of lecture-recitation and 6 hours of laboratory for 4 credits; while a year course (2-3) (1-6)6 would indicate 2 hours of lecture-recitation and 3 hours of laboratory for the first semester followed by 1 hour of lecture-recitation and 6 hours of laboratory the second semester, for a total credit of 6.
5. The prerequisites for various subjects are shown. In exceptional cases, the Head of the Department may waive a prerequisite requirement by notifying in writing the Registrar of such action.
6. Subjects numbered 100-199 are normally given at the freshman level.
   Subjects numbered 200-299 are normally given at the sophomore level.
   Subjects numbered 300-399 are normally given at the junior level.
   Subjects numbered 400-499 are normally given at the senior level.
   Subjects numbered 500 and above are restricted to graduate students.
   No subject below 300 may be counted toward the Master of Science degree.

SUBJECTS ARE LISTED ALPHABETICALLY BY SUBJECT CLASSIFICATIONS, IRRESPECTIVE OF THE DEPARTMENT INVOLVED.

CHEMISTRY

Chem. 101 GENERAL INORGANIC CHEMISTRY (4-3)5
Required of all freshmen — Prof. Chace and Staff

This subject is concerned with the basic principles of chemistry and a consideration of non-metallic elements and their compounds.

Chem. 102 GENERAL INORGANIC CHEMISTRY (3-3)4
Prerequisite: Chem. 101 — Prof. Chace and Staff
Required of all freshmen except those in Courses IV and IX

In this subject, attention is focused on metals and their compounds. In the laboratory, special emphasis is placed on textile applications.

Chem. 104 GENERAL INORGANIC CHEMISTRY (3-0)3
Prerequisite: Chem. 101 — Prof. Chace
Required of freshmen in Courses IV and IX

In this subject, attention is focused on the metals and their compounds and a continuation of the studies of the basic principles is made.

Chem. 112 QUALITATIVE ANALYSIS (2-3)3
Prerequisite: Chem. 101 — Prof. Daley
Required in Courses VIII and IX

This subject covers the systematic qualitative analysis of inorganic compounds using semi-micro technique.

Chem. 122 QUALITATIVE ANALYSIS (3-6)5
Prerequisite: Chem. 101 — Prof. Daley
Required in Course IV — Messrs. Brown and Lavrakas

This subject covers the systematic qualitative analysis of inorganic compounds.

Chem. 124 ELEMENTARY STOICHIOMETRY (2-0)2
Prerequisites: Chem. 101, Math. 101 — Prof. Daley
Required in Courses IV, VIII and IX — Mr. Brown

The elementary calculations of inorganic chemistry and qualitative analysis.

Chem. 201-202 ORGANIC CHEMISTRY (3-3) (3-3)8
Prerequisite: Chem. 102 *or* 104 — Prof. Scattergood
Required in Courses IV, V, VIII and IX — Mr. Kelley

A study of the important classes of carbon compounds and the fundamental theories of organic chemistry.

Chem. 204 CHEMICAL TECHNOLOGY OF FIBERS (2-0)2
Prerequisite: Chem. 201 — Mr. Masaschi
Required in Course IV

A study of the chemical properties of the textile fibers and the resulting reactions with chemicals and dyes which are of technical importance. Both natural and artificial fibers are considered.

Chem. 211-212 QUANTITATIVE ANALYSIS (1-6) (1-6)6
Prerequisite: Chem. 122 — Profs. Fickett and James
Required in Course IV

This subject covers the fundamental principles of quantitative analysis. The first semester emphasizes gravimetric analysis. Volumetric techniques are covered during the second semester.

Chem. 213 QUANTITATIVE ANALYSIS (2-6)4
Prerequisite: Chem. 112 — Prof. James
Required in Courses VIII and IX

This subject covers the common analytical operations of gravimetric and volumetric analysis and the calculations involved.

CHEM. 221 INTRODUCTION TO TEXTILE CHEMISTRY (2-0)2
Prerequisite: CHEM. 102 PROF. HOWARTH
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This subject is designed for the non-chemist and consists of a series of lectures covering the various processes preliminary to dyeing. The preliminary treatments given the natural and manufactured fibers are covered as well as the action and properties of the textile chemicals used in these processes.

CHEM. 222 INTRODUCTION TO TEXTILE CHEMISTRY (1-3)2
Prerequisite: CHEM. 221 PROFS. HOWARTH AND EVERETT
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This is a continuation of CHEM. 221. The application of the various classes of dyes to the natural and manufactured fibers is covered. The methods of dyeing, the fastness properties of the different classes of dyes and the nature and use of dyeing assistants is taken up. The principles covered in the lectures are illustrated by work in the laboratory.

CHEM. 231 LIBRARY (1-0)1
Prerequisite: CHEM. 104 MR. MASASCHI
Required in Courses IV and VIII

Lectures on the use of the literature and the methods of library classification with particular emphasis on the use of chemical and textile literature.

CHEM. 241-242 STOICHIOMETRY (1-0) (1-0)2
Prerequisite: CHEM. 124 PROFS. FICKETT AND JAMES
Required in Course IV

Calculations of gravimetric analysis are studied in the first semester; calculation of volumetric analysis, in the second semester.

CHEM. 311 TEXTILE QUANTITATIVE ANALYSIS (1-6)3
Prerequisite: CHEM. 212 PROFS. FICKETT AND JAMES
Required in Course IV

This subject is devoted to basic principles of chemical analysis covered in CHEM. 122 and 211-212 and to the examination of materials used in the textile mill, the dye house, and the finishing plant. Among the materials covered are water, oils, soaps, bleaching agents, etc.

CHEM. 312 or 313 TEXTILE QUANTITATIVE ANALYSIS (1-3)2
Prerequisite: CHEM. 311 PROFS. FICKETT AND JAMES

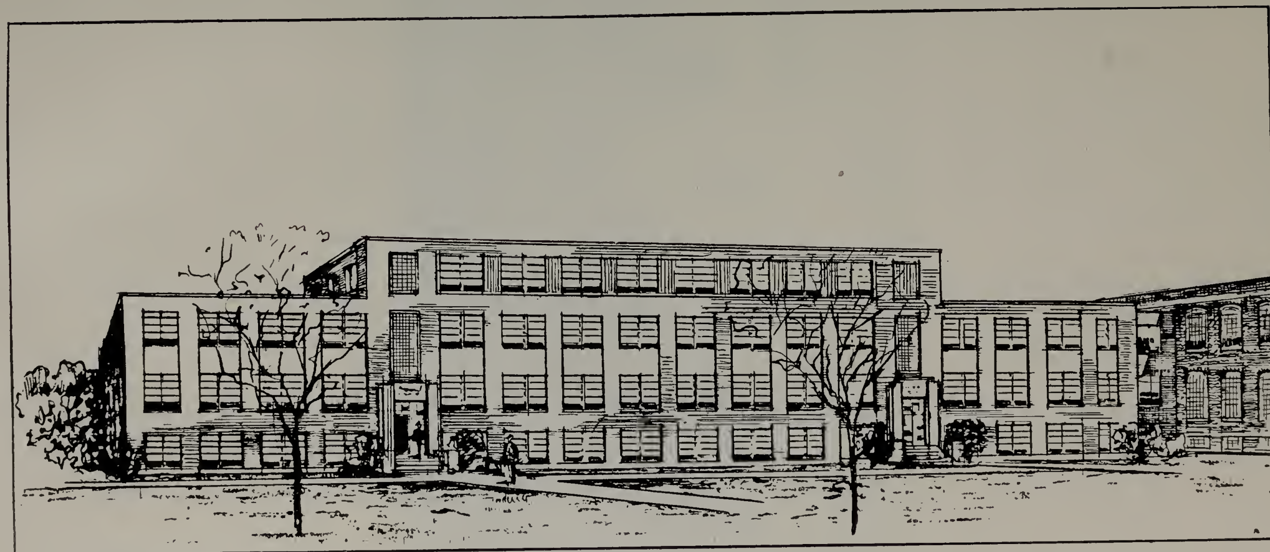
This is a continuation of CHEM. 311. The analysis of such materials as vegetable, animal, lubricating and sulfated oils is considered.

CHEM. 321-322 TEXTILE CHEMISTRY (2-3) (2-3)6
Prerequisites: CHEM. 202, ENG. 104 *and* PHYS. 202
Required in Course IV PROFS. HOWARTH AND EVERETT

This subject is designed primarily for those majoring in chemistry and is the first of four semesters relating to the chemistry of all types of textile fibers, i.e. cotton, wool, rayon, nylon, flax, etc. Among the major topics covered the first year are: (1) Operations preliminary to dyeing, (2) Water in the textile industry, (3) Theory of dyeing, (4) Coloring matters, (5) Dyeing processes.

CHEM. 331-332 PHYSICAL CHEMISTRY (3-1½) (3-3)7½
Prerequisites: CHEM. 104, MATH. 204 PROF. CHACE
and PHYS. 202 MR. LISIEN
Required in Courses IV, VIII and IX

A study of the important principles of physical chemistry, i.e., gaseous, liquid, solid states; elementary chemical thermodynamics; determination of molecular



Paper and Leather Engineering Building

Portion of Textile Testing Laboratory

weights; viscosity; surface tension; etc.

Topics covered include dilute solutions, chemical equilibrium, phase equilibrium, free energy and electrical properties of solutions.

CHEM. 333 INDUSTRIAL STOICHIOMETRY (3-0)3
Prerequisite: CHEM. 331 *taken concurrently* PROF. BROUGHTON
Required in Course VIII

This comprises the study of some important operations in the chemical industry, e.g., sulfuric acid, and in the pulp and paper industry from the standpoint of the application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Recirculatory processes will also be studied.

CHEM. 335 CHEMISTRY OF THE PROTEINS (3-0)3
Prerequisites: CHEM. 202 *and* CHEM. 331 *taken concurrently* PROF. CHOUINARD
Required in Course IX

A study of the chemistry of proteins with special emphasis on the collagen molecule.

CHEM. 342 ORGANIC QUALITATIVE ANALYSIS (1-3)2
Prerequisites: CHEM. 122 *and* 202 PROF. SCATTERGOOD
MR. KELLEY

The purpose of this subject is to acquaint the student with the methods of the qualitative determination of unknown organic compounds.

CHEM. 352 CHEMICAL ENGINEERING (3-0)3
Prerequisites: CHEM. 104, MATH. 204 *and* PHYS. 202 MR. MASASCHI
Required in Course VIII

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying, with special emphasis on textile application and textile chemical machinery.

CHEM. 362 GENERAL COLLOID CHEMISTRY (2-0)2
Prerequisite: CHEM. 331 PROF. BROUGHTON
Required in Courses IV, VIII and IX

This subject covers the basic general principles of colloidal chemistry, followed by elementary analyses of important problems encountered in amorphous materials such as paints, cellulosic products, leather, paper and textiles.

CHEM. 411-412 ADVANCED TEXTILE CHEMISTRY AND DYEING (2-9) (2-9)10
Prerequisite: CHEM. 322 PROFS. HOWARTH, EVERETT AND SCATTERGOOD
Required in Course IV MR. PEIRENT

Continuation of CHEM. 321-322, covering (1) Color matching and color combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, and (5) Dye house management.

CHEM. 414 SPECIAL STUDIES IN DYEING (1-6)3
Prerequisite: CHEM. 412 *or permission of instructor* PROFS. HOWARTH, EVERETT, MR. PEIRENT

A subject designed for those desiring more than the required work in dye application. Further work in dye application is given, also dye testing, color matching and textile printing.

If the student has a particular problem in the application of dyes, time will be allotted for its study.

CHEM. 422 ADVANCED CHEMICAL TEXTILE TESTING (2-3)3
Prerequisites: CHEM. 202, CHEM. 212, CHEM. 431 *and* TEX. 312 MR. MASASCHI

A series of lectures and laboratory periods designed to supplement the textile testing given in TEX. 311-312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content and fiber damage is followed by some dyestuff identification. The use of optical equipment such as the colorimeter, pH apparatus, spectrophotometer, ultra violet radiation and infrared radiation is also studied.

CHEM. 431 MACROMOLECULAR CHEMISTRY OF TEXTILE PROCESSES (2-0)2
Prerequisites: CHEM. 332 *and* CHEM. 362 PROF. SKINKLE
Required in Course IV

The principles of general colloid chemistry are applied to specific textile applications. Wetting, detergency, the fibers themselves, dyes, and finishing processes are studied from the colloidal aspect.

CHEM. 441 ADVANCED CHEMICAL ENGINEERING (3-0)3
Prerequisite: CHEM. 352 PROF. BROUGHTON
Required in Course VIII

An advanced study of the subjects covered in CHEM. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This is an elective continuation of CHEM. 352.

CHEM. 451-452 NATURAL AND SYNTHETIC HIGH POLYMERS (3-0) (3-0)6
Prerequisites: CHEM. 202, CHEM. 332, MATH. 204 *and* PHYS. 202 PROF. SCATTERGOOD

This presents the fundamental organic and physical chemistry of cellulose, rubber, wool and the various addition and condensation polymers. The main topics covered are (1) chemical structure; (2) physical structure; (3) orientation and fine structure; (4) molecular weight, molecular weight distribution, methods of determining molecular weight; (5) addition polymerization; (6) condensation polymerization; (7) the mechanical properties of high polymers and (8) the commercial uses of these substances.

An attempt is made to correlate the material so that an understanding of the behavior of high polymers in textile materials is developed.

CHEM. 461 or 462 MICROBIOLOGY (1-3)2
Prerequisite: CHEM. 202 MR. BROWN

This subject considers the fundamentals of mycological and bacteriological theory briefly but in sufficient details so that the problem of the microbiological deterioration of textiles, paper, and leather may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance are considered in the laboratory.

CHEM. 464 ADVANCED MICROBIOLOGY (1-3)2
Prerequisite: CHEM. 461 *or* 462 MR. BROWN

This work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc. are typical.

CHEM. 471 ADVANCED INORGANIC CHEMISTRY (2-0)2
Prerequisite: CHEM. 332 MR. LAVRAKAS

Such topics and theories as the hydrogen bond, Werner's co-ordination theory, theories of acids and bases and the electronic theory of valence, which are important to the understanding of present day chemistry, are discussed in detail.

Chem. 472 INORGANIC PREPARATIONS (2-3)3
Prerequisite: Chem. 104 Prof. Chace

The purpose of this subject is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

Chem. 501 or 502 APPLICATIONS OF COLOR MEASUREMENT
Credits and hours to be arranged Prof. Skinkle
Prerequisite: Chem. 422 *or equivalent*

This subject covers the description and use of transmission and reflection colorimeters and also the spectrophotometers and recording spectrophotometer. The calculations from the results are studied and the use of the instruments in dye application research is thoroughly investigated.

Chem. 511 or 512 SURFACE ACTIVE AGENTS Prof. Skinkle
Credits and hours to be arranged
Prerequisite: Chem. 431

A laboratory study, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial applications.

Chem. 521 or 522 TEXTILE TESTING PROBLEMS Prof. Skinkle
Credits and hours to be arranged
Prerequisite: Chem. 422

Special problems relating to the design and evaluation of improved analytical or testing procedures.

Chem. 523 or 524 METHODS OF GROUP RESEARCH Prof. Skinkle
Credits and hours to be arranged
Limited to 4-6 students

A series of conferences and laboratory periods utilized in carrying out a sample industrial research by the concerted action of the group. The problem is analyzed, its various parts distributed to individuals and the results combined by the group. The students alternate in supervising the work of the group.

Chem. 525 or 526 EVALUATION OF FINISHING AGENTS
Credits and hours to be arranged Prof. Skinkle

A laboratory study designed to teach the use of the various test methods and instruments in evaluating the effect of finishing treatments on the tactile and end-use properties of a fabric.

Chem. 531-532 TEXTILE CHEMISTRY SEMINAR (2-0) (2-0)4
Prerequisite: Permission of Instructor Prof. Skinkle

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

COTTON

Cotton 201-202 COTTON CARDING (3-6) (3-6)10
Prerequisite: Eng. 102 *and* Eng. 112 Mr. Pope
Required in Course I

This is a study of the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing and roving. Considerable time is devoted to the studying of cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. The laboratory work consists of a series

of studies of cotton fibers from the point of view of classing and basic physical characteristics. Experiments and studies of the card room machinery are designed to acquaint the student with typical mill equipment and how it is used in processing commonly used cottons. The mill processes are studied in detail, using specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

COTTON 203-204 COTTON CARDING (3-2) (3-2)8
Prerequisite: ENG. 102 *and* ENG. 112 MR. POPE
Required in Course VI-G

This subject is similar to COTTON 201-202, but requires considerably less laboratory time. The subject is designed for those with a more general interest in textile manufacturing.

COTTON 211 COTTONS (1-1)1½
Prerequisites: COTTON 201 *taken concurrently,* ENG. 102 *and* ENG. 112 PROF. MERRILL
Required in Course I

This subject consists of lectures and laboratory work, supplementary to COTTON 201 for those students who major in cotton. Some time is spent on the details of cotton fiber growth and structure and in comparing cotton with other fibers. The economic importance of cotton is studied and sources of information regarding cotton and its processing are given to the class.

COTTON 222 COTTON WASTE PROCESSING (1-1)1½
Prerequisite: COTTON 201 PROF. MERRILL
Required in Course I

For those specializing in Cotton Manufacture, this subject provides a survey of the methods and machinery used in processing cotton wastes, or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment and the manufacturing processes. Samples of wastes and products are used to demonstrate the possibilities in this field.

COTTON 301 COTTON SPINNING (2-5)4
Prerequisite: COTTON 202 PROF. GOODWIN
Required in Course I

This subject is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning. Particular consideration is given to the production of yarns for different uses and to methods by which desired characteristics may be obtained. All the calculations regarding yarns and spinning frames are thoroughly studied and problems are assigned for student practice. The laboratory work consists of a series of experiments, synchronized with the lectures, to demonstrate and supplement class room discussions. In the laboratory, standard industrial machinery is used to process cottons such as are commonly used in cotton mills.

COTTON 302 COTTON WINDING AND TWISTING (2-10)5
Prerequisite: COTTON 301 PROF. GOODWIN
Required in Course I

This subject is a continuation of the subject of spinning, in which the instruction covers the conclusion of spinning, spooling and the various types of winding, the twisting of common and fancy yarns, threads, cords and rope. (Some of these items are optional.) All the calculations regarding winders and twisters are thoroughly studied and problems are assigned for student practice. Laboratory experiments, synchronized with classroom lectures, are used as explained for COTTON 301.

Cotton 303 COTTON SPINNING (2-2)3

Prerequisite: Cotton 204 Prof. Goodwin

Required in Course VI-G

This subject is similar to Cotton 302, but the time devoted to laboratory practice is shortened.

Cotton 304 COTTON WINDING AND TWISTING (2-2)3

Prerequisite: Cotton 303 Prof. Goodwin

Required in Course VI-G

This subject is similar to Cotton 301, but the time devoted to laboratory practice is very much shortened.

Cotton 311 STAPLE FIBER MANUFACTURE (1-1)1½

Prerequisite: Cotton 301 *taken concurrently* Prof. Merrill

Required in Course I

Using the preparatory subjects as a background, this subject offers a study of the methods of manufacture of various staple fibers, such as wool, rayon, or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the subject is planned to take advantage of the new developments as they appear. A considerable amount of the work in this subject is of the discussion type, which aims to correlate all the work on yarn manufacture and to bring it to bear on the processing of staple fibers.

Cotton 322 COTTON QUALITY CONTROL (1-0)1

Prerequisite: Cotton 301 Prof. Merrill

Required in Course I

While it is customary to point out defects in the materials during the processing in all the lecture and laboratory work, this subject provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this subject. Every effort is made to develop the diagnostic ability of the student so that he may readily recognize and remedy defects as he meets them.

Cotton 331 or 332 COTTON YARN MANUFACTURE SURVEY (3-1)3

Not open to students in Course I or VI-G Mr. Kent

For students with but a secondary interest in Cotton Manufacture, this survey outlines the processes used and the principles of cotton yarn manufacture. The work considers cotton qualities and production, the processes of opening, picking, carding, combing, drawing, roving, spinning, winding and twisting.

While this subject consists primarily of lectures, it is planned to include some laboratory demonstrations. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

Cotton 401 MILL ORGANIZATION (4-0)4

Prerequisite: Cotton 302 *or* 304 Prof. Merrill

Required in Courses I and VI-G

This subject correlates all of the work on Cotton Manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and for the handling of staple fibers are carefully covered. Estimates are made of the machinery necessary to keep plants in balance with some consideration of the best arrangements for economical handling.

Cotton 402 MANAGEMENT PROBLEMS (2-0)2

Prerequisite: Cotton 401 Prof. Merrill

Required in Course I

This subject supplements the one in Mill Organization with some added detail regarding the work in Mill Organization. It includes work on job descriptions, job assignments and work load studies. Some time is spent considering arrangement of machinery for practical routing and operation, auxiliary equipment necessary and materials handling problems for efficient manufacturing.

DESIGN

Des. 101 or 102 ELEMENTARY TEXTILE DESIGN (2-1)2

Prof. Golec

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and the derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves, including figured and colored effects; producing chain and draw from the design, and vice versa; extending and extracting weaves.

Des. 103 or 104 YARN CALCULATION (1-0)1

Prof. Golec

This subject includes relations and determinations of yarn numbers of cotton, woolen, worsted, linen, silk, and synthetics; grading of yarns, folded, ply, novelty and fancy yarns.

Des. 112 HANDLOOM WEAVING (0-3)1

Prof. Golec

This work consists of making original patterns and cloth construction. This subject correlates with the textile design work and aims to stimulate and inspire the student-designer to realize possible combinations of weave and color in a variety of yarns in order to produce fabrics for different purposes.

Des. 122 PERSPECTIVE (0-2)1

Prof. Rosatto

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing.

Des. 132 FREEHAND DRAWING (0-2)1

Prof. Rosatto

This subject consists of freehand practice, by means of progressive steps, in training the eye to see accurately and to develop skill in depicting desired effects. It includes quick sketching and finished drawings of objects and of nature to build a drawing vocabulary which will be an aid to decorative expression.

Des. 203-204 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisites: Des. 102 *and* 104 Prof. Fox

Open only to students in Course III

In the first semester, consideration is given to cotton fabrics using plain, twill, or sateen constructions, and employing stripe, check, or plaid patterns. In the second semester, fabrics studied are those having extra warp and extra filling

figured patterns, together with Bedford cords, velveteens, plushes and corduroy fabrics. In both semesters, the work includes the analysis of the fabrics as well as the necessary calculations required to reproduce them or to construct fabrics of similar character.

DES. 211-212 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6
Prerequisites: DES. 102 *and* 104 MR. GRAY
Open only to students in Course III

In the first semester, instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second semester, instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas and extra warp and filling figures.

DES. 222-223 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4
Prerequisites: DES. 101 *and* 103 PROF. FOX
Required in Courses I, V (222)and VII
Not open to students in Course III

This subject offers work similar but less detailed than the material covered in DESIGN 203-204 and DESIGN 301-302.

DES. 224 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2
Prerequisites: DES. 101 *and* 103 PROF. FOX
Required in Courses VI-E and VI-G
Not open to students in Course III

This is a skeleton course patterned after DES. 222-223.

DES. 232-233 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4
Prerequisites: DES. 101 *and* 103 MR. GRAY
Required in Courses II and VII
Not open to students in Course III

This subject offers work similar to but less detailed than the material covered in DESIGN 211-212 *and* DESIGN 311-312.

DES. 234 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2
Prerequisites: DES. 101 *and* 103 MR. GRAY
Required in Courses VI-E and VI-G
Not open to students in Course III

This is a skeleton subject patterned after DESIGN 232-233.

DES. 242 DECORATIVE DESIGN (0-2)1
Suggested preliminaries: DES. 122 *and* 132 PROF. ROSATTO
Open only to students in Course III

Through the principles of decorative design an understanding is acquired for the proper balance, distribution and repetition of motifs suitable for both the woven and the printed patterns. Historic designs of different periods and peoples are covered to supply the student with a background of decorative information. This source of inspiration is coupled with modern thought and application, as an aid to producing appropriate present-day decorative textiles.

DES. 251-252 COLOR (1-1) (1-1)4
Open to students in Courses III and VII PROF. ROSATTO

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating

stripes, checks, plaids, and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question.

Due to the work required as a part of the laboratory, extra credit is allowed.

DES. 262 COLOR (1-1)1
Required in Course I PROF. ROSATTO

This subject includes the same general information as DES. 251-252 but in less detail.

DES. 271 COLOR (1-1)1
Required in Course II PROF. ROSATTO

This subject includes the same general information as DES. 262 but deals with blends of colored stock.

DES. 301-302 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6
Prerequisite: DES. 204 PROF. FOX
Open only to students in Course III

In the first semester, synthetic fabrics are analyzed covering design, construction, yarns, both spun and filament, and finished fabric characteristics. Also covered in this semester are cotton ply fabrics and include the weave and construction of two-ply, three-ply and four-ply fabrics together with the analysis of these fabrics in wide woven and narrow woven non-elastic belts and webs. The second semester covers wide and narrow woven elastic webs, piques, and lappet and swivel woven fabrics, as well as Mitchelins, loose and fast-back quilting fabrics and toilet cloths.

DES. 303 SYNTHETIC FABRIC DESIGN AND ANALYSIS (1-2)2
Prerequisite: DES. 222 *or* 224 PROF. FOX
Required in Course V

This subject covers the comparison and analysis of various synthetic fabrics as to the construction, yarn denier, filament size, and weave, as well as finished fabric characteristics.

DES. 311-312 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6
Prerequisite: DES. 212 MR. GRAY
Open only to students in Course III

This includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs as well as the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, size of yarn and value. Particular attention is given to the construction of new designs by the use of suggestion sheets as well as to the new fabrics to be constructed upon a base fabric, previously analyzed, in the manner outlined on the suggestion sheets and keeping within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. This subject is restricted to woolen and worsted fabrics, but includes blends with other fibers, as well as filament yarn combinations for fancy effects.

DES. 401 LENO FABRIC DESIGN AND ANALYSIS (1-1)1½
Prerequisite: DES. 302 *or permission of instructor* PROF. FOX
Open only to students in Course III

A complete study is given in leno fabric design, using the modern steel doups and super-doups.

DES. 402 ADVANCED TEXTILE DESIGN AND ANALYSIS (1-2)2
Prerequisites: DES. 312, DES. 401, WEAV. 302 *or permission of instructor* PROF. GOLEC
Open only to students in Course III

The first half of the semester is devoted to the study of Leavers Lace including history, manufacture, finishing, a detailed study of the Leavers machine, and the basic principles of lace design and drafting. The second half of the semester covers a study of embroideries and rugs. Schiffli embroidery includes the Schiffli machine, basic principles of Schiffli design, manufacturing, finishing and types and end uses of embroidery. Rugs include a study of the principles of construction of the analyses of Chenille, Wilton, Brussel, Tapestry, Velvet, and Axminster carpets.

DES. 411-412 JACQUARD DESIGN AND WEAVING (1-2) (1-2)4
Prerequisites: DES. 204, DES. 242, WEAV. 302 PROFS. GOLEC AND HOELLRICH
Required in Course III

This subject correlates the instruction in weaving on the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, to choose the proper weave for both the background and foreground, to cut cards and lace, and to weave the fabric.

DES. 413 or 414 JACQUARD DESIGN (0-2)1
Prerequisite: DES. 101 *or* 102 PROF. GOLEC

This is an elective subject in which the student is taught to transfer a given motif to cross section paper, to choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to enable the student to appreciate the complete operation from the motif to the loom.

DES. 421 or 422 DESIGN AND WEAVING SEMINAR STAFF
Credits and hours to be arranged
Prerequisite: Major in Course III or by special permission

This subject consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

ECO. 201-202 ECONOMICS (3-0) (3-0)6
Required in Courses I, II, III, IV, V, VI-E; VI-G, and VII PROF. CUSHING

This course is a basic one in the principles and practices of economics. It deals briefly with economic history, showing how the present economic system has evolved from past systems. It shows how the experience of the past can aid in the solution of present problems.

ECO. 311 ECONOMIC STATISTICS (3-0)3
Required in Course VII PROF. EDLUND

This subject covers the basic concepts of the statistical method with special emphasis on those approaches of most interest to the student of management. Topics covered include: measures of central tendency, graphic methods, dispersion, skewness, sampling, normal curve, index numbers, correlation, time series, secular trend, seasonal variation, business cycle and statistical forecasting.

Eco. 321-322 PRINCIPLES OF MARKETING (3-0) (3-0)6
Required in Course VII PROF. EDLUND
MR. MANDELL

Eco. 321 is an introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. This subject will cover the history and economic importance and the functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor and other intermediaries. It will also consider the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Eco. 322 is a continuation of Eco. 321. Some of the topics studied are: economic aspects of fashion, branding, sales promotion and advertising, market research, analysis of distribution costs, forecasting, market potentials, price policies, legal aspects of marketing, vertical integration, sales planning and control and the complete campaign.

Eco. 341-342 PRINCIPLES OF ACCOUNTING (3-0) (3-0)6
Required in Course VII MR. MANDELL

This subject is a survey of accounting principles with emphasis upon the nature, interpretation, and utilization of accounting data. The introductory material will include a consideration of the economic significance of accounting, the underlying accounting concepts, the theory of debits and credits, and the organization and use of accounting records. Attention will then be given to the preparation and interpretation of reports and statements of financial position, such as the balance sheet and the statement of profit and loss. Finally, the subject material will be projected to include a study of basic credit considerations such as determination of risk, analysis of mercantile reports and the studying of creditor-debtor relationship.

Eco. 342 is planned to give a knowledge of modern methods of cost accounting with emphasis upon their application to textile manufacturing processes. It includes discussion of methods of handling and accounting for raw materials, direct labor, overhead and its distribution, normal costs and their pre-determination, budgeting, cost reports and their use for control purposes.

Eco. 343 ACCOUNTING AND COSTING (3-0)3
Required in Courses II, III, VI-E, VI-G and IX MR. MANDELL

A condensation of Eco. 341-342 with about one half the subject devoted to a study of the underlying principles of accounting records and about one half devoted to the methods of textile cost accounting and systems employed.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING (4-0)4
Required in Course VII PROF. EDLUND

A comprehensive subject dealing with the fundamental principles of advertising and salesmanship. Topics covered include: psychology of selling and advertising, copy writing, layout, printing and engraving, testing and research, planning an advertising campaign, government restrictions, types of media, radio advertising, trademarks, building a selling talk, fundamentals of salesmanship, types of personal selling, personality, retail salesmanship, training, etc.

Eco. 351 TEXTILE MARKETING (2-0)2
Required in Courses I, II, III, IV, V and VI-G PROF. EDLUND

This subject is a condensation of the more important parts of Eco. 321 and 322, of particular interest to those not specializing in distribution. It will survey the marketing channels for textiles, chief intermediaries, fashion, branding, marketing research, vertical integration and sales promotion.

Eco. 412 INDUSTRIAL MANAGEMENT: PRINCIPLES AND PROBLEMS (4-0)4
Required in Courses I, II, III, V, VI-E, VI-G, VII and IX — Prof. Robertson, Mr. Mandell

This subject is divided into four general areas: Backgrounds of Modern Industry; Organization of the Industrial Enterprise; The Operation of the Modern Industry; and Coordination of the Productive Processes. The text material is supplemented with current readings and case material.

Among the topics covered are: Risks, Forecasting, Financing, Product Development, Plant Layout, Production Controls, Personnel Management, Time and Motion Studies, Job Evaluation, and Wage and Salary Administration.

Eco. 421 FOREIGN TRADE (3-0)3
Prerequisite: Eco. 202 — Mr. Mandell
Required in Course VII

This subject will study the growth and development of foreign trade, international commercial policies, transportation and communication facilities, and international finance. A good portion of the term's work will be devoted to a study of the practical aspects of exporting and importing. Examples will be given in the textile field wherever possible and actual documents relating to foreign trade will be exhibited and used in regular class work.

Eco. 431-432 SELLING POLICIES (3-0) (3-0)6
Prerequisite: Eco. 322 — Prof. Edlund
Required in Course VII

This subject will cover the development of administrative policy and guiding principles in the marketing, pricing, styling and merchandising of textile products. Topics covered include: sales supervision and control, credit policies, inventory control, standardization and simplification, the sales contract, arbitration, trade associations, principles of wholesaling and retailing, use of cost accounting in distribution.

The second term is conducted by the seminar method and includes discussions and reports on business cases involving all phases of management and distribution policy.

Eco. 468 CORPORATE FINANCE (3-0)3
Prerequisite: Eco. 342 *or* 343 — Mr. Mandell
Required in Course IX

This subject will study the instruments of corporate finance, the financing of business enterprises, the legal nature of the corporation, technical features of stocks and bonds, principles of capitalization, working capital management, surplus and dividend policies, business combinations and business reorganizations.

ENGINEERING

Eng. 102 MECHANISM (4-0)4
Required in Courses I, II, V, VI-E, VI-G and VII — Prof. Thomas, Mr. Baker

The principles studied are of general application, textile machinery in particular furnishing an unusually large variety of specific examples. Frequent reference is made to these examples in the development of the subject. Some of the important topics covered are gearing and gear train design, belting and pulley calculations, cone and stepped pulley design, cam design, epicyclic gear trains and intermittent motion devices.

Eng. 104 MECHANISM (2-0)2
Required in Courses III, IV, VIII and IX — Prof. Thomas
Not open to students in Courses VI-E and VI-G

This subject is an abbreviation of Eng. 102 and is designed for those students not majoring in engineering.

Eng. 111 ENGINEERING DRAWING (0-6)2
Required in all courses Prof. Gelinas and Staff

This subject consists of both freehand and mechanical drawing and covers the following items: lettering, geometric construction, orthographic projection, isometric and cabinet drawing, and dimensions.

Eng. 112 ENGINEERING DRAWING (0-6)2
Required in Courses I, II, V, VI-E, VI-G, VII, VIII and IX Prof. Gelinas and Staff

A continuation of Eng. 111 which includes the following topics: auxiliary views, cross sections, advanced dimensioning, sketching of machine parts, working drawings, tracing and blueprinting, intersections and developments.

Eng. 122 MACHINE TOOL LABORATORY (1-2)1
Required in Courses I, II, V, VI-E, VI-G, VII and VIII Messrs. Bell, Ainsworth and Staff

The objective of this subject is to give the student an insight into the processing of metals through lectures and practical laboratory applications covering the basic machine tools such as the lathe, shaper, drill-press, and milling machine, and also the uses of measuring instruments, threads, and gears. Lectures and demonstrations cover topics such as pattern work, foundry practice, die-casting, welding and forging.

Eng. 201 MACHINE DRAWING (0-3)1
Prerequisite: Eng. 112 Prof. Gelinas
Required in Courses VI-E and IX

This subject is made up of several short problems involving centers of gravity, counterweights, cam layouts, piping, welding, sheetmetal drafting and assembly drawings.

Eng. 212 HEAT AND POWER (2-2)3
Prerequisite: Phys. 201 Prof. Wells
Required in Course II
Not open to students in Course VI-E or VI-G

This subject is similar to Eng. 311 but is briefer and is designed for those not majoring in engineering.

Eng. 221 TEXTILE MECHANISM (1-2)1½
Prerequisites: Eng. 102 *and* Eng. 112 Prof. Hindle
Required in Course VI-E

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

Eng. 222 APPLIED MECHANICS (3-0)3
Prerequisites: Math. 201 *and* Phys. 101 Mr. Baker
Required in Courses VI-E and IX

This subject covers the fundamentals of statistics and kinetics, including such topics as force systems, laws of equilibrum, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

Eng. 233 MACHINE TOOL LABORATORY (0-3)1
Required in Course VI-E Messrs. Bell and Ainsworth

This subject is a continuation of Eng. 122 giving practical and more detailed

instruction in such operations as lay-outs, filing, drilling, planing and shaping, and places special emphasis on precision work.

ENG. 301-302 ADVANCED APPLIED MECHANICS (3-0) (3-0) 6
Prerequisites: ENG. 222 *and* MATH. 202 PROF. HINDLE
Required in Course VI-E

This subject covers the general topic of strength of materials; including such topics as simple stresses, strain, bending moments, shearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, and stress analysis by strain gage methods.

ENG. 311 PRINCIPLES OF HEAT ENGINEERING (3-2)4
Prerequisites: ENG. 102, MATH. 202 *and* PHYS. 201 PROF. WELLS
Required in Course VI-G

The basic principles of thermodynamics, properties of steam and its utilization in manufacturing processes, and the combustion of fuels are considered in this subject.

A brief treatment of steam engines, turbines and pumps is also included. Special consideration is given to the use of steam in textile mills.

ENG. 312 HEAT ENGINEERING (3-2)4
Prerequisites: MATH. 202 *and* PHYS. 201 PROF. WELLS
Required in Course VI-E

The purpose of this subject is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures, and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS (3-0)3
Prerequisites: MATH. 201 *and* PHYS. 101 MR. BAKER
Required in Courses VI-G and IX

A more elementary and condensed treatment of ENG. 301-302.

ENG. 331 MILL ENGINEERING (3-0)3
Prerequisite: ENG. 222 PROF. HINDLE
Required in Course VI-E

This subject consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints; calculation of allowable floor loads; stresses in beams and columns; machinery layout and the use of the transit in elementary surveying.

ENG. 332 ENGINEERING MATERIALS (2-0)2
Prerequisite: PHYS. 202 PROF. HINDLE

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treatment; also the properties and uses of non-metallic engineering materials such as timber, cement, concrete, rubber, plastics and mechanical fabrics.

ENG. 342 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4
Prerequisite: PHYS. 321 PROF. HORTON BROWN
Required in Courses VI-E and VIII

At the beginning of this subject polyphase circuits are considered. The greater part of the subject, however, is devoted to direct-current generators and motors with a study of their construction and characteristics. The accompanying laboratory work illustrates the various methods of measuring polyphase power, and

of determining the characteristics of direct-current generators and motors. To be followed by Eng. 401.

Eng. 344 ELECTRICAL MACHINERY (3-2)4
Prerequisite: Phys. 321 Prof. Horton Brown
Required in Courses VI-G and IX

This subject is a condensation of Eng. 342 *and* Eng. 401.

Eng. 351 EXPERIMENTAL APPLICATIONS OF STATISTICS (3-0)3
Prerequisite: Math. 201 *or* 203 Prof. Ball
Required in Courses VI-E, VIII and IX

The subject deals with those fundamental statistical measures which are required for the analysis of experimental data, and with the practical applications of statistics to qualify control and to the planning of industrial experiments.

Eng. 401 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4
Prerequisite: Eng. 342 Prof. Horton Brown
Required in Courses VI-E and VIII

This is the second semester of work in the electrical field having been preceded by Eng. 342 in the junior year.

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method compared with laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for this motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

Eng. 402 TEXTILE APPLICATIONS OF ELECTRICITY (2-3)1
Prerequisite: Eng. 344 *or* 401 Prof. Horton Brown
Required in Courses VI-E and VI-G

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. Trips are made to local mills to see the equipment in actual operation.

Eng. 411 ADVANCED HEAT ENGINEERING (2-2)3
Prerequisite: Eng. 312 Prof. Wells
Required in Course VI-E

The topics developed are kinematics of reciprocating steam engines, steam turbines, pumps, condensers, and internal combustion engines. Special attention is given to the mechanical principles on which the steam engine operates, with detailed discussion of the valve gear and governing devices. Consideration is given to the underlying heat theory and to the details of construction of the various parts of the machines. During the latter part of the subject, the historical development, classification and types of turbines and internal combustion engines are discussed.

Eng. 421 ENGINEERING DESIGN OF TEXTILE STRUCTURES (2-0)2
Prerequisites: Eng. 321, Math. 202 *and* Phys. 202 Prof. Ball

Required in Course VI-E

This subject correlates engineering properties of textile materials, engineering principles and textile processing in the design of textile structures with desired properties. The subject matter is presented in two major divisions. The first deals with the geometry of yarns and fabrics, and shows the extent to which it is possible to design the dimensions of a textile structure for a certain functional use, or to predict the dimensional changes which will occur during such use. The second division deals with the design from the standpoint of the stresses, strains and energy changes which the end-use imposes, and is based upon the information supplied by analyses of load-elongation diagrams for one-time and for repeated loadings of the textile structural material.

ENG. 422 TEXTILE PROCESS INSTRUMENTATION (2-0)2
Prerequisite: PHYS. 202 PROF. THOMAS
Required in Courses VI-E and VI-G

This subject is divided into three parts. First, a study is made of the indicating and recording instruments used to measure such common textile process variables as pressure, temperature, humidity, liquid level, fluid flow, etc.

The second part covers an analysis of the mechanisms (pneumatic and electric) which are used to control these variables, and includes a detailed discussion of the final control elements, such as valves and motor levers, which are associated with the controller mechanisms.

Finally, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, and finishing are studied from data obtained from actual mill installations.

ENG. 424 MACHINE DESIGN (2-2)3
Prerequisites: ENG. 221, 233 *and* 302 PROF. HINDLE
Required in Course IX

Dealing first with the design of fundamental elements, the work leads to the design of critical parts of some machines.

ENG. 431 ADVANCED PHYSICAL TESTING (1-3)2
Prerequisite: TEX. 312 PROFS. BALL AND THOMAS

This subject provides a more detailed analysis of the textile testing methods currently utilized in the industry, both in quality control and in research, extending the laboratory work to cover a wider variety of equipment than is studied in TEX. 311-312.

ENG. 502 STATISTICAL QUALITY CONTROL (3-0)3
Prerequisite: ENG. 351 STAFF

This subject includes a study of the various types of control charts for maintaining quality of manufactured products and of the several types of sampling plans for the reduced inspection of manufactured products and of raw materials. Applications of the foregoing statistical techniques to industry in general are discussed, with special emphasis on their application to the textile and other industries.

ENGLISH AND HUMANITIES

ENGL. 101-102 ENGLISH COMPOSITION AND LITERATURE (3-0) (3-0)6
Required of all freshmen PROFS. DOW AND RILEY
MR. STEARNS

This course is a basic one in rhetoric and composition, relating specifically to the four forms of discourse — description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

ENGL. 201 or 202 SPEECH (2-0)2
Prerequisite: ENGL. 102 PROF. DOW
Required in all courses

The aim of this subject is to achieve effective delivery of various types of speech. All kinds of delivery — extemporaneous, impromptu, memorized — and the like are studied and analyzed.

ENGL. 211 or 212 BUSINESS ENGLISH (1-0)1
Prerequisite: ENGL. 102 PROF. DOW
Required in all courses

Analysis and practice in letter writing, a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity and the objectives of this course.

ENGL. 222 APPRECIATION OF LITERATURE (3-0)3
Prerequisite: ENGL. 102 PROF. DOW

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals — the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

FIN. 401-402 WOOLEN AND WORSTED FINISHING (2-3) (2-3)6
Prerequisite: CHEM. 102 PROF. NOWELL
Required in Course II

This subject is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbing, brushing, shearing and pressing.

FIN. 411 or 412 WOOLEN AND WORSTED FINISHING (3-3)4
Prerequisite: CHEM. 102 *or* 104 PROF. NOWELL
Not open to students in Course II

This subject is a similar but abbreviated version of FIN. 401-402, designed for students not majoring in wool manufacture.

FIN. 421-422 COTTON FINISHING (2-3) (2-3)6
Prerequisites: CHEM. 222 *and* TEX. 302 PROF. McDONALD
MR. PEIRENT
Required in Course I

All of the major physical and chemical operations necessary for the conversion into the finished state of staple cotton gray fabrics made from cotton are covered. In addition to inspection, singeing, washing, padding, drying, calendering, etc., the preliminary wet processing operations through dyeing are illustrated. Among the types of finishes employed are those for backfilling, softening, repelling, stabilizing, decating, etc., as well as the themoplastic and thermosetting resins.

FIN. 431 COTTON AND SYNTHETIC FINISHING (3-3)4
Prerequisite: TEX. 302 PROF. McDONALD
Required in Courses VII-E, VI-G, and VII MR. PEIRENT

The subject is offered as the final step in the integration of cotton and synthetic fibers from the raw material to the consumer product. It consists of all major operations necessary in the transformation of the staple grey fabrics of

the above content except the bleaching and dyeing which is given separately. These operations consist of shearing, singeing, washing, padding or mangling, miscellaneous drying, calendering, etc. Among the group of finishes are back-filling, softening, repelling, stabilizing, decating, etc. Also considered are the application of thermoplastic and thermosetting resins by padding and coating.

FIN. 432 COTTON AND SYNTHETIC FINISHING (3-3)4
Prerequisites: TEX. 302 *and* CHEM. 202 PROF. MCDONALD
Required in Courses IV and V
In general, this subject is similar to FIN. 431, but with emphasis placed on the chemical nature and action of the finishing agents, such as starches, surface acting agents, resins, etc.

KNITTING

KNIT. 401 KNITTING (2-5)4
Prerequisites: DES. 223 *or* 233 *or* 234; ENG. 102 *and* ENG. 112 PROF. JONES
This subject is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

KNIT. 403 or 404 KNITTING (2-3)3
Prerequisites: DES. 103; ENG. 102 *and* ENG. 112 PROF. JONES
This subject is similar to KNIT. 401, but requires less laboratory time.

KNIT. 412 ADVANCED KNITTING (2-5)4
Prerequisite: KNIT. 401 PROF. JONES
This is an advanced subject for students who are specializing in knitting. With the approval of the department head, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

GERMAN 201-202 TECHNICAL GERMAN (3-0) (3-0)6
Required in Course IX PROF. CUSHING
This course is an introductory one in the basic elements of German, leading to a working knowledge of technical German. This subject is aimed primarily at developing a reading ability in scientific German.

GERMAN 301-302 ADVANCED TECHNICAL GERMAN (3-0) (3-0)6
Prerequisite: GERMAN 202 *or equivalent* PROF. CUSHING
GERMAN 301 *may be taken without continuing* GERMAN 302
This course is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

LEATHER

LEA. 101 SURVEY OF LEATHER (1-0)0
Required in Course IX STAFF
A brief history of leather, its raw materials and its relation to man and industry.

LEA. 202 APPLIED LEATHER ANALYSIS (1-6)3
Prerequisite: CHEM. 213 PROF. CHOUINARD
Required in Course IX

A subject designed to acquaint the student with the accepted Methods of Analysis of the American Leather Chemists Association and other supplementary procedures.

LEA. 301-302 LEATHER MANUFACTURE (3-6) (3-6)10
Required in Course IX PROF. CHOUINARD

This is the student's introduction to the general technology of leather manufacture. The first semester is devoted to the study of government regulations in imported hides and skins, studying the purchasing of hides and skins and classifying various hide damages. This is followed by work on the handling of raw stock at the tannery, unhairing, bating and hide classification. The second semester is concerned primarily with the study of vegetable tanning, chrome tanning and various other types of tanning. In the work throughout the year the material covered in lectures is supplemented by laboratory studies on a small scale.

LEA. 303 HISTO-PATHOLOGY OF ANIMAL TISSUES (1-6)3
Prerequisite: CHEM. 202 STAFF
Required in Course IX

The histological study of animal hide as regards cell reproduction, glands and thermostat mechanism growth of hide fibers, elastin, nerves and grain patterns.

LEA. 304 MICROSCOPY IN TANNING (1-3)2
Prerequisite: LEA. 303 STAFF
Required in Course IX

This subject is designed to educate the student in the use of a microscope as an aid in the study of hides and leathers under various conditions. The technique of using normal, fluorescent and polarized light is taught as well as the application of staining with some emphasis on photomicrography.

LEA. 322 TANNING MECHANISMS (3-0)3
Prerequisite: CHEM. 202 PROF. CHOUINARD
Required in Course IX

The general study of the various concepts applied to the understanding of what constitutes Tanning, both practical and theoretical. This will involve a study of the raw materials as well as the finished product.

LEA. 401-402 LEATHER MANUFACTURE (3-6) (3-6)10
Prerequisite: LEA. 302 PROF. CHOUINARD
Required in Course IX

A continuation of the study into the technology of leather manufacture covering the various currying treatments applied to rough leather such as fat liquoring, stuffing, dyeing and the various mechanical operations of setting, stretching, etc. It is intended to show how widely the physical properties of leather may be varied and controlled by the proper application and selection of these numerous operations and treatments.

LEA. 404 PROPERTIES OF LEATHER (2-3)3
Prerequisites: ENG. 351 *and* LEA. 401 STAFF
Required in Course IX

A practical and theoretical study of the characteristics of leather in relation to the end use. Studies will be made on measuring and classifying the effect of changes in manufacturing procedure, both chemical and physical. Leather because it is a natural product varies considerably within the same hide. Thus, the nature of this variation is very important and the study of any changes affecting it are in turn important.

LEA. 411-412 LEATHER PROBLEMS (1-6) (1-6)6
Prerequisite: LEA. 302 PROF. CHOUINARD
Required in Course IX

This subject is designed primarily to enable the student to put into practical application the various scientific principles of physics, chemistry, mathematics, economics, etc. on problems of an industrial nature. This may encompass anything from the design and layout of any of a number of special leather plants to the suggested solution of practical problems which arise in the operation of a modern leather business.

MATHEMATICS

MATH. 101-102 COLLEGE MATHEMATICS (4-0) (4-0)8
Required of all freshmen PROF. HARRY BROWN AND STAFF

The work in the first term consists of algebra, plane trigonometry, and an introduction to analytic geometry. Algebra is reviewed through quadratics and then logarithms, simultaneous equations, and theory of equations are studied. In plane trigonometry, the solution of right and oblique triangles is reviewed and identities and equations are taken up. Instruction in the use of the slide rule is given and the use of approximate data is discussed. Between two and three weeks are devoted to equations of the straight line.

In the second term, the following topics are considered: equations of various curves, differentiation of algebraic functions, maximum and minimum values, rates and differentials.

MATH. 201-202 ANALYTIC GEOMETRY AND CALCULUS (3-0) (3-0)6
Prerequisite: MATH. 102 PROF. HARRY BROWN
Required in Courses VI-E, VI-G and IX AND STAFF

In the first term the following topics are treated: the circle, parabola, ellipse, hyperbola, indefinie integrals, summation of integration and applications of integration. In the second term the topics treated are: differentiation of transcendental functions, methods of integration, solid analytic geometry, polar coordinates, partial differentiation, and empirical formulas.

MATH. 203-204 MATHEMATICS FOR CHEMISTS (4-0) (2-0)6
Prerequisite: MATH. 102 PROFS. HINDLE
Required in Courses IV and VIII AND OUELLETTE
MR. SABBAGH

This subject is a continuation of MATH. 101-102. The first term consists of analytic geometry and calculus including the following topics: the conic sections, indefinite integrals, summation by integration, areas, volumes, pressures, exponential, logarithmic and trigonometric functions.

The second term includes measurements and computation rules, properties of logarithmic equations, triangular graphs, semi-logarithmic and logarithmic graphs, exponential growth and decay, curve fitting, chemical applications of differential equations, and partial derivatives.

MATH. 205 MATHEMATICS (4-0)4
Prerequisite: MATH. 102
Required in Courses I, II, III, V and VII PROF. OUELLETTE AND MR. DEVEJIAN

In this subject, which follows MATH. 101-102, students not majoring in chemistry or engineering take up conic sections, integration of algebraic functions with applications to areas, construction of nomographic charts, and derivation of empirical equations.

MATH. 402 DIFFERENTIAL EQUATIONS (3-0)3
Prerequisite: MATH. 202 *or* 204 PROF. OUELLETTE

The following topics are treated: a review of series and partial differentiation, first and second-order differential equations, and first and second-order partial differential equations. The practical applications illustrated are designed for the chemist and the engineer.

PAPER

PAPER 101 SURVEY OF PULP, PAPER, AND PAPER USES (1-0)0
Required in Course VIII PROF. BROUGHTON

This subject treats briefly of the history of paper, present day production and uses so that the student can better understand the industry.

PAPER 201-202 PULP AND PAPER MANUFACTURE (3-0) (3-0)6
Prerequisite: CHEM. 102 PROF. BROUGHTON
Required in Course VIII

Lectures on the production and technology of pulp and paper.

PAPER 302 PULP AND PAPER MANUFACTURE (3-0)3
Prerequisite: PAPER 202 PROF. BROUGHTON
Required in Course VIII

This is a continuation of the earlier subject.

PAPER 303 WOOD TECHNOLOGY (3-3)4
Required in Course VIII STAFF

This comprises an elementary study of the principal woods used in pulping, their occurrence and principal characteristics. This lecture work is accompanied by training in microscopy leading eventually to fiber analysis of a finished paper.

PAPER 312 PULP AND PAPER TESTING AND ANALYSIS (4-7)6
Prerequisites: CHEM. 213 *and* PAPER 202 STAFF
Required in Course VIII

A series of lectures and laboratory periods designed to give a thorough knowledge of the testing methods and analyses carried out in the industry. Particular attention will be paid to the theory and principles of the test methods employed.

PAPER 401 PRACTICE WORK IN INDUSTRY 18 CREDITS
Prerequisite: PAPER 302 STAFF
Required in Course VIII

In order to give the student as thorough a knowledge of industrial problems and practices as possible, it is planned in cooperation with several mills and converting plants to set up practice stations. The students will spend several weeks at each of these stations working on technical problems of interest to the mill management but under the supervision of a member of the Institute staff.

PAPER 403 MATERIALS OF CONSTRUCTION, CORROSION 2 CREDITS
Prerequisite: PAPER 401 *taken concurrently* STAFF
Required in Course VIII

This subject, given at the Practice Stations, covers the common construction materials used in the industry and their ability to stand up under various conditions of use. It will be illustrated by examples in the plants studied.

PAPER 404 PAPER COATING AND CONVERTING (3-0)3
Prerequisite: PAPER 302 STAFF
Required in Course VIII

This subject covers the principal operations of the converting industry. Coating, treating and impregnating, laminating, embossing and creping will be treated and, if time permits, printing.

PAPER 412 INDUSTRIAL CELLULOSE CHEMISTRY (1-0)1
Prerequisite: CHEM. 202 PROF. BROUGHTON
Required in Course VIII

The manufacture and use of the chief cellulose derivatives will be reviewed. In addition, various chemical teratments for cellulose in the paper and textile fields will be discussed.

PAPER 414 ADVANCED PAPER PROBLEMS (2-6)4
Prerequisite: PAPER 401 STAFF
Required in Course VIII

This is designed to give the senior an opportunity to work upon a problem connected with some phase of the paper or paper converting industry. Problems will be selected by the student and staff in collaboration.

PHYSICAL EDUCATION (2-0)0

PROF. CUSHING
MESSRS. MOREY AND YARNALL

All members of the Freshman Class are required to take a course in physical training conducted under the direction of an instructor in physical education. It is planned to help each student meet reasonable standards of physical fitness and through regularity and continuity of physical exercise to maintain good physical condition. The men are taught basic skills in several team sports. Students on athletic squads are not required to attend these classes during the season they are actively engaged in that sport.

PHYSICS

PHYS. 101 PHYSICS (4-1)4½
Required of all freshmen PROF. THOMAS AND STAFF

The fundamental principles of this subject are considered absolutely essential to a thorough understanding of the operation of all machinery, textile or otherwise. Some of the topics treated in this subject are linear and angular velocity, uniform and accelerated motion, mass, momentum, inertia, effect of force in producing motion, centrifugal force, work, power, energy, principle of moments and its application, parallelogram and triangle of forces with applications, resolution and composition of forces, efficiency of simple machines, hydrostatics, elements of hydraulics, circular and harmonic motions.

PHYS. 201-202 PHYSICS (3-2) (3-2)8
Prerequisite: PHYS. 101 PROF. HARRY BROWN
Required in all courses MESSRS. CHASE AND HALL

This is a continuation of PHYS. 101 and is a basic subject relating to the laws and principles of physics and their application. The topics taken up the first term are: wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are: reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatics, fundamental laws of direct currents and electrolysis, electronics, and elements of nuclear physics.

PHYS. 321 ELECTRONICS VI-E (3-2)4
Prerequisite: PHYS. 202 Others (3-1)3½
Required in Courses VI-E, VI-G, VIII and IX PROF. HORTON BROWN

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. The elements of vacuum and gaseous-

tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation are discussed as well as industrial photoelectric relays, time delay relays, and Thymotrol motor controls.

PHYS. 401 TEXTILE MICROSCOPY (1-3)2

Prerequisites: PHYS. 202 *and* TEX. 312 — PROF. HARRY BROWN

Applications of the microscope to textile materials are emphasized in this subject. It includes methods of sectioning, measurement of cotton immaturity and mercerization, determination of denier of rayon, wool grading, fiber identification, quantitative analysis of fiber mixtures and their practical applications. Some of the more advanced aspects of critical microscopy which are essential for the best visual work and photographic practice are considered. Some time is devoted to photographic work and the use of polarized light.

PHYS. 402 TEXTILE PHYSICS (2-3)3

Prerequisites: MATH. 202, PHYS. 202, TEX. 312 — PROF. HARRY BROWN

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The topics taken up include heat transmission of textile materials; color measurement; calculation of tristimulus values; transformation to dominant wave-length, colorimetric purity and brightness; measurement of refractive index of fibers; applications of phase microscopy; flourescent microscopy; use of X-ray diffraction methods to determine crystal orientation and structure of fibers; spectrographic analysis; investigation of mineral elements in textile fibers; accurate methods of measuring stress, strain, viscosity, etc.

PHYS. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT

PROF. HARRY BROWN

Credits and hours to be arranged

Prerequisites: MATH. 202 *or* 204 *and* PHYS. 202

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectrophotometers.

SOCIAL SCIENCES

SOC. SCI. 212 WORLD HISTORY SINCE 1900 (3-0)3

PROF. CUSHING

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situation during the war years, 1914 to 1918, and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of th course content will concern the two-decade intermission, 1919-1939, with attention to such factors as the rise of new states, the origin and development of new concepts of nationalism, racism, and other phenomena, and the final alignment of world powers for World War II.

The emphasis in the latter part of the subject will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

Soc. Sci. 221 ECONOMIC HISTORY; THE UNITED STATES (3-0)3
Required in Courses V and VIII Prof. Robertson

This subject offers a study of the foreign and American backgrounds of the economic development of the United States since 1800. Special emphasis is placed upon the Industrial Revolution in America prior to the Civil War and upon the growing international economic importance of American manufacturing and trade during the period.

The major emphasis is upon the post-Civil War development of transportation, finance, manufacturing, and commerce and on the influence of these and other factors in the rise of corporate ownership and mass production and in the development of our present-day machine economy. Particular attention will be given to the economic influences of the two World Wars and to the post-war trends in general business conditions and their effects upon the national economy.

Soc. Sci. 222 MAN AND HIS ENVIRONMENT (3-0)3
Required in Course VII Mr. Stearns

This subject deals with man's morphological and physiological adaptations to his surroundings and with his struggle against the hostile forces in his environment. Emphasis is given particularly to the fields of ecology, genetics and eugenics.

Soc. Sci. 301 MODERN ECONOMIC PROBLEMS (3-0)3
Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and IX Prof. Robertson

An intensive study of current developments in the American economy, with emphasis on such fields as security, welfare, labor unionism, labor economics, ownership and management of industry, and trends in government regulation. Lectures, selected readings and case material will be utilized.

Soc. Sci. 302 MODERN LABOR PROBLEMS (3-0)3
Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and VIII Prof. Robertson

The subject will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the term the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of this study will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techneques of the bargaining table and the problems in drafting, interpreting and administering the modern labor contract.

Soc. Sci. 311 PSYCHOLOGY (3-0)3
Required in Course VII Staff

The subject introduces the student to the place of psychology in the life of the individual and society and seeks to increase the student's understanding of man's mental and emotional processes. The subject matter deals with physiological bases of behavior and experience, attention, perception, memory, thinking, emotions, intelligence and personality in terms of the whole person in his social setting.

Soc. Sci. 312 SOCIOLOGY (3-0) 3
Required in Course VII Staff

This subject seeks to broaden the student's understanding of man's behavior as a unit of society. Topics studied include culture and related anthropological concepts, culture and society, groups, aggregations and institutions, social organization, social and cultural change, collective behavior, social drives, social psychology and the possibilities of human progress.

Soc. Sci. 401 or 402 INDUSTRIAL RELATIONS SEMINAR (2-0) 2
Prerequisite: Permission of Instructor Prof. Robertson
Required in Course V

This subject will give a small selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial relations. Case material and hypothetical problems in modern labor management will provide the basis for the study by the group.

Soc. Sci. 461 PERSONNEL MANAGEMENT (3-0) 3
Prof. Robertson

This subject involves a comprehensive study of modern labor management techniques in the recruiting, selection, training, and placement of members of the work force. Major emphasis is placed upon the development and maintenance of personnel administration agencies and procedures within the framework of present-day American industry, with special attention to such matters as employee health and safety, welfare and recreation programs, wage and salary administration, training and education, and management relations with labor organizations.

In addition to text material and selected readings, problems will be drawn from actual cases for study and solution by the students. Every effort will be made to acquaint the class with current personnel administration practices in industrial organizations of various types, and to give an appreciation of the importance and magnitued of the labor management function.

Soc. Sci. 463 BUSINESS LAW (3-0) 3
Required in Course IX Prof. Robertson

This subject will cover the basic principles of commercial law. Topics studied include: contracts, agency, sales, partnerships, corporation, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guarantee, and bankruptcy.

Soc. Sci. 465 MANAGEMENT PROBLEMS SEMINAR (2-0) 2
Prerequisite: Permission of Instructor Staff

A seminar for a group of selected students who will, under the guidance of the instructor, investigate one or more areas of special interest to the student in the field of finance, production or distribution. The results of the students' analysis and research will be presented in a formal report which will be permanently on file in the library.

SYNTHETIC TEXTILES

Syn. 102 ORIENTATION IN SYNTHETIC TEXTILES (1-0) 1
Required in Course V Profs. Harris and Frederick

This orientation for freshmen who have elected to major in synthetic textiles has for its purpose the general integration, in the mind of the student, of the various subjects in his curriculum in terms of his educational objective. Since the student does not begin intensive study in synthetic textiles until his junior year, it is of vital importance that he be fully cognizant of the significance of the basic educational program of the first two years.

Syn. 301 FILAMENT YARN PROCESSING (2-0)2

Required in Course V Prof. Frederick

This subject deals with the processing of natural and man-made continuous filament fibers from the time they are made available to the textile industry by the manufacturer until they are ready for processing into fabric forms. The nomenclature, purposes, means of accomplishment, and results obtained in the various operations of soaking, winding, throwing, twist setting, coning, and single end sizing are covered in the lectures.

Syn. 302 THROWING PLANT ORGANIZATION (2-0)2

Prerequisite: Syn. 301 Prof. Frederick

Required in Course V

This subject is essentially a continuation of Syn. 301, with the emphasis being placed upon actual plant organization, processing procedures, and quality control. Plant layouts from machinery viewpoints are discussed and assigned for study. Field trips to local plants are an integrated part of the class work.

Syn. 311 MANUFACTURE OF SYNTHETIC FIBERS (3-0)3

Prerequisite: Chem. 202 Prof. Harris

Required in Course V

This subject covers the manufacture of man-made fibers. The rayon, estron, polyamide, polyester, vinyl, protein, mineral and metalic fibers are considered from the standpoint of their manufacturing and economic aspects. The subject is approached with the view of presenting the types of processes and the chemistry (reactions and structures) involved in the manipulation of natural high polymers and the synthesis and manipulation of synthetic high polymers into useful textile fibers.

Syn. 312 STRUCTURE AND PROPERTIES OF SYNTHETIC FIBERS (3-0)3

Prerequisites: Chem. 202 *and* Phys. 202 Prof. Harris

Required in Course V

In this subject, a study is made of the fundamental structure and properties of the manufactured fibers. The material is developed with the aim to relate the structures of the fibers to their properties and to lay the foundation for the more advanced work covered in Syn. 411-412.

Syn. 322 FILAMENT YARN PROCESSING SURVEY (2-0)1½

Prerequisite: Tex. 102 Prof. Frederick

Not open to students in Course V

A survey of the methods of handling natural and synthetic fibers in filament form designed to give the student a broad picture of the differences and their significances betweeen staple and filament yarn production. Some of the lecture time is devoted to laboratory demonstration, and outside assignments may be made involving special study of the laboratory equipment.

Syn. 331-332 FILAMENT YARN LABORATORY (0-3) (0-3)2

Prerequisite or Concurrent Subject: Syn. 301

Required in Course V Prof. Frederick

This subject covers the laboratory aspects of Syn. 301, and consists of planned experiments and demonstrations involving the use of throwing machinery and processes by the student. Experiments include various yarn soaking studies, winding, twisting, coning and single end sizing operations, and quality control and power studies.

SYN. 411-412 PROPERTIES AND APPLICATIONS OF SYNTHETIC FIBERS (3-0) (3-0)6
Prerequisite: SYN. 312 PROF. HARRIS
Required in Course V

This subject is a continuation of SYN. 312. Much of the time will be spent on considerations of the fundamental properties of man-made fibers in relation to each other and to the behaviors of the finished textile resulting from these basic properties and the geometry imposed upon the fibers in the textile. To make the material more useful, comparisons are made with natural fibers and their textiles. Recent advances in the manufacture and study of fibers will be discussed whenever necessary to keep the subject matter included in SYN. 311 and 312 up to date.

SYN. 452 SYNTHETIC TEXTILES SEMINAR (2-0)2
Prerequisites: SYN. 302 *and* 411 PROFS. HARRIS AND FREDERICK
Required in Course V

A general discussion of the problems encountered in the synthetic textile field, including economics, manufacture, processing, properties and various aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar develops an objective viewpoint of the subject by the student.

TEXTILES — GENERAL

TEX. 101 SURVEY OF TEXTILES (2-0)1
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII PROF. EDLUND

This subject is designed to give the student a broad general knowledge of the textile industry to enable him to choose a course more intelligently and to orient him in the relations between the various parts of the industry and the social and economic patterns in which they exist. Regardless of his field of specialization, it gives him an elementary knowledge of the entire textile field that should make his subsequent work more purposeful.

TEX. 102 INTRODUCTION TO FIBERS (2-0)2
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII PROF. HARRIS

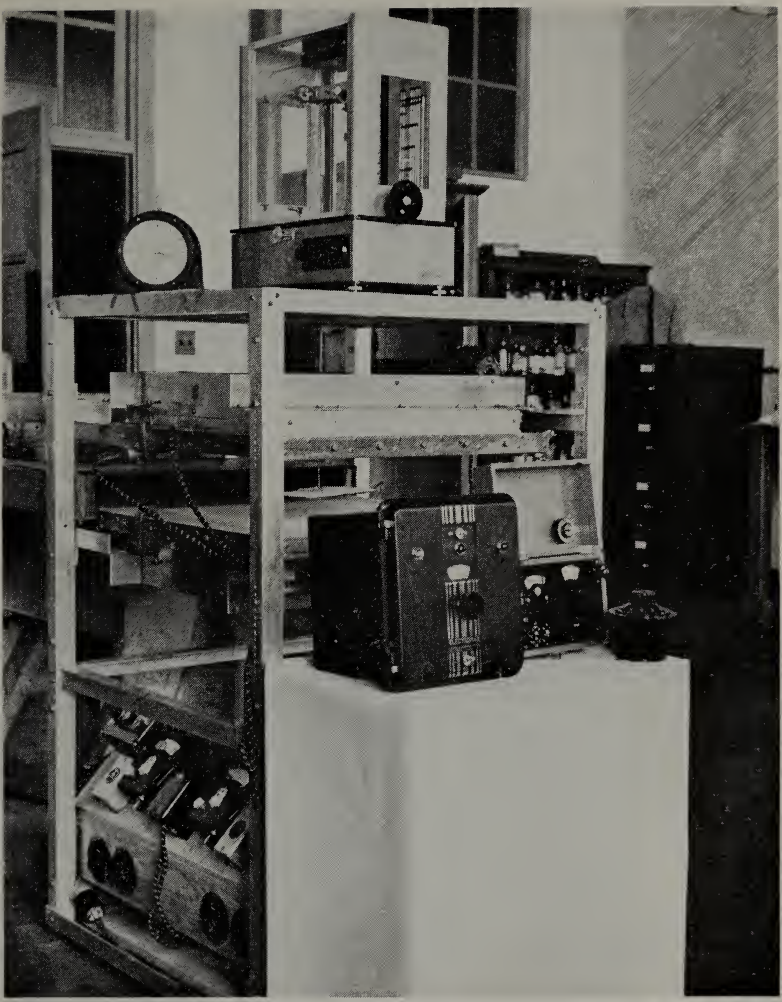
A general survey of the fibers used in the textile industry, including natural cellulosic (soft and hard), protein, and mineral fibers and the man-made fibers. The sources (location and distribution), production methods and statistics, the economics, and the preparation of the fiber for textile uses will be discussed. An introduction to the elementary properties of fibers making them suitable for specific textiles will also be presented.

TEX. 241 LIBRARY (1-0)1
Required in Courses I, II, III, V, VI-E, VI-G, and VII MR. KATZ

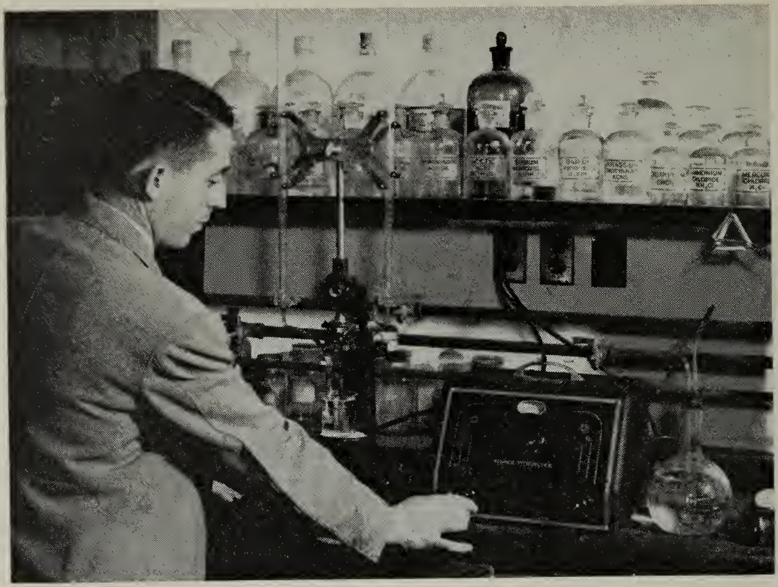
This is a subject which introduces the student to the effective use of a library and familiarizes him with the past and current sources of information on textile topics.

TEX. 302 FABRICS (2-0)2
Prerequisites: DES. 101 *and* 103 *or* DES. 102 *and* 104 PROF. GOLEC
Design Major Prerequisites: DES. 204 *and* 212
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

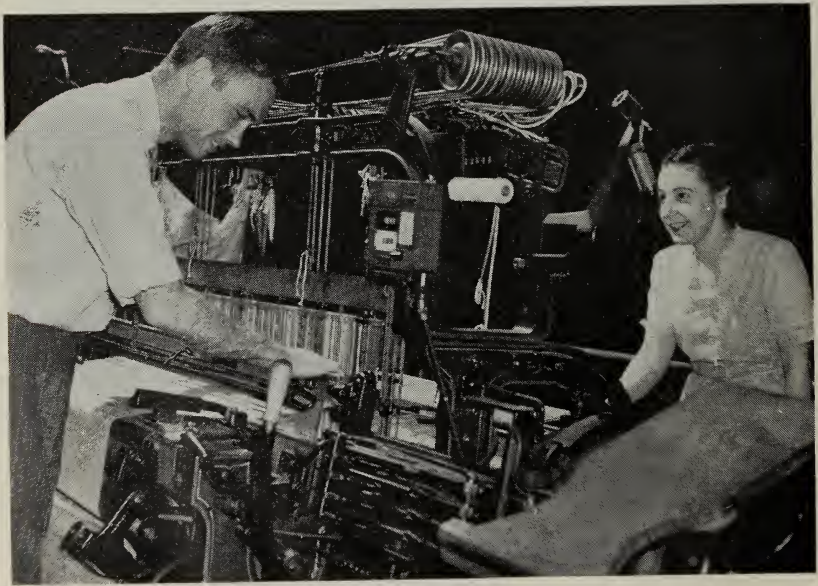
This subject is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial



Experimental Infra-red Dryer



Fisher Titrimeter



Weaving

uses. An analytical discussion is used so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc. used.

TEX. 311-312 TEXTILE TESTING (2-2) (2-2)6
Prerequisites: CHEM. 102, MATH. 102 *and* PHYS. 202 — PROF. FREDERICK
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

This subject is designed to provide a foundation for more advanced work in testing, and is of sufficient breadth to benefit those students whose main need is an understanding and appreciation of the scope of testing and evaluation in the textile industry. The subject matter covers an applied approach to the statistical treatment of experimental data, and the basic mechanical or physical, chemical, and optical tools and techniques available to the industry for product control, development and evaluation. Primary emphasis is placed upon an understanding of the principles involved and an integration of the various phases of textile testing into a unified whole.

TEX. 501 or 502 METHODS OF RESEARCH (2-0)2
Prerequisite: Graduate Students only — PROFS. BALL AND HARRY C. BROWN

A seminar to familiarize the student with the philosophy and methods of research, current problems in textile research and of the further use of textile literature.

TEX. 590-591 THESIS RESEARCH
Credits and hours to be arranged

WEAVING

WEAV. 201-202 WEAVING (2-4) (2-4)7
Required in Course III — MESSRS. ARMSTRONG AND HUNTER

The first semester's work deals with the study of the cam loom, its principal and auxiliary motions, a comparison with other types of looms, and a study of weaving terms and cloth defects in the weaving process. Narrow fabric weaving is incorporated in the laboratory exercises. The second semester's work covers all methods of warp preparation of all yarns with emphasis upon the conditions favorable to each or combinations of systems.

WEAV. 211-212 WEAVING FOR MANUFACTURERS (2-2) (2-2)5
Required in Courses I, II and V — MESSRS. ARMSTRONG AND HUNTER

This subject is similar to WEAV. 201-202, but utilizes less laboratory time.

WEAV. 221-222 WEAVING FOR ENGINEERS (2-0) (2-0)4
Required in Course VI-G — MESSRS. ARMSTRONG AND HUNTER

This subject, designed for non-manufacturing majors, includes lecture material similar to that in WEAV. 201-202, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 301-302 WEAVING (2-4) (2-4)7
Prerequisite: WEAV. 201 — PROFS. HOELLRICH AND MERRILL
Required in Course III

This subject covers dobby weaving and includes single and double index, single and double cylinder, chains, timing and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-

ups, card cutting, timing and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics and silk. This subject also covers pile cloth weaving, carpet weaving and leno weaving.

WEAV. 311-312 WEAVING FOR MANUFACTURERS 5 (2-2) (2-2) 5
Prerequisite: WEAV. 201 *or* 211 — PROFS. HOELLRICH AND MERRILL
Required in Courses I, II and V

This subject is similar to WEAV. 301-302, but utilizes less laboratory time.

WEAV. 321-322 WEAVING FOR ENGINEERS (2-0) (2-0) 4
Prerequisite: WEAV. 201 *or* 211 *or* 221 — PROFS. HOELLRICH AND MERRILL
Required in Course VI-G

This subject, designed for non-manufacturing majors, includes the same lecture material as WEAV. 301-302, but includes no laboratory work other than lecture-demonstration and assignments.

WEAV. 333-334 WEAVING FOR ENGINEERS (1-2) (1-2) 3
Prerequisites: DES. 223, 233 or DES. 224, 234 — PROF. MERRILL AND MR. HUNTER
Required in Courses VI-E and VII

This subject covers warp preparation and weaving with emphasis on basic principles and eliminating details. The different systems of warp preparation are described and compared. Each type of loom is described and the capabilities and limitations of each are discussed. Considerable time is devoted to fabric defects, their cause and correction.

WOOL

WOOL 211-212 TOP MAKING (2-6) (2-6) 10
Prerequisites: ENG. 102 *and* 112 — PROF. KOROSKYS
Required for Course II

This subject covers a study of the preparation of wool and allied hair fibers for processing on all systems of manufacture. Special emphasis is placed on wool buying, grading, sorting, scouring and drying, carbonizing, burr picking, worsted carding, backwashing, gilling, Warner Swasey Pin Drafter, Holdsworth's Gill Reducer, Pacific Evenness Tester, Noble combing, tow to top conversion of synthetic fibers, Pacific Converter, top testing, and a study of classification of commercial tops.

Credit for laboratory has been increased to compensate for the preparation of reports required as a part of this work.

WOOL 215-216 TOP MAKING (2-2) (2-2) 6
Prerequisites: ENG. 102 *and* 112 — PROF. KOROSKYS
Not open to students in Course II
Required in Course VI-G

This subject covers the same lecture material as WOOL 211-212, but the laboratory time is considerably reduced.

WOOL 301-302 WOOLEN YARNS (2-4) (2-4) 7
Prerequisite: WOOL 212 *or* 216 — MR. R. L. BROWN, JR.
Required for Course II

This subject covers woolen system fiber blending, oiling, picking, carding, spinning, twisting, and the handling of reused and reprocessed fiber. Old rags and new clips are graded and sorted. Rag sources are covered as are rag picking, lumping, shredding, garnetting and complete manipulation from reprocessed clips and waste to fiber ready for carding and making into yarn. The processing of wool, manufactured, and synthetic fiber, is studied in theory and practice. Special emphasis is given to details of woolen machinery such as tape and ring

doffer type condensers, broadband and Apperly intermediate feeds, automatic weighing feeders, peralta rolls, card drives, and modern mule and ring spinning. The lecture study is augmented with many laboratory experiments and problems which are performed by the student.

WOOL 311 or 312 SURVEY OF WOOL MANUFACTURE (3-1)3
Prerequisite: TEX. 102 *suggested but not obligatory*
Required in Courses I, III, IV, V, VI-E and VII
PROF. KENNEDY
Not open to students in Course II or VI-G

This subject is designed for those who are not majoring in wool manufacture and presents a comprehensive survey of woolen and worsted yarn, reprocessed and reused fiber, and felt manufacturing processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

WOOL 321-322 WORSTED YARNS (3-3) (3-5)9
Prerequisite: WOOL 212 *or* 216 PROF. BURTT
Required for Course II

This subject consists of both lectures and laboratory work. It supplements the subject matter given in course 211-212, Top Making. Lectures cover advanced gilling; French combing; top analysis and stapling; worsted yarn manufacture, including drawing, spinning, and twisting for both the English and French systems; colored blending of dyed wool tops, also blending wool top with other fibers. The laboratory work covers each phase of the lecture work. Experiments run concurrently with the lectures. Gilling theories are demonstrated; French combing wool is processed into top on the French comb and both French and English system yarns are manufactured. Fundamentals are stressed in both lectures and laboratory.

WOOL 323-324 WOOLEN YARNS (2-2) (2-2)5
Prerequisite: WOOL 212 *or* 216 MR. R. L. BROWN, JR.
Required in Course VI-G
Not open to students in Course II

This subject covers the same lecture material as WOOL 301-302 but the laboratory time is reduced.

WOOL 325-326 WORSTED YARNS (3-2) (3-2)7
Prerequisite: WOOL 216 PROF. BURTT
Required in Course VI-G
Not open to students in Course II

This subject covers the same lecture material as WOOL 321-322 but the laboratory time is considerably reduced.

WOOL 412 WOOLEN AND WORSTED MILL ORGANIZATION (4-0)4
Prerequisites: WOOL 302 *and* 322 STAFF
Required for Course II

This subject covers a recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system of manufacture.

It also summarizes previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades to cover balanced mill equipment necessary to produce worsted cloth from wool top on both English and French systems of manufacture.

DEGREES CONFERRED IN 1950

Recipients of Honorary M.S. Degrees

Hon. Paul A. Dever, *Governor of Massachusetts*
Samuel Pinanski
Edward R. Schwarz
Abbott Stevens
George H. Varney

Master of Science in Textile Chemistry

Milton Charatz
B.S., Lowell Textile Institute, 1949

Edward Cherowbrier, Jr.
B.S., Lowell Textile Institute, 1949

Jerrold Nelson Finnie
B.S., McGill University, 1948

Joseph Valentine Kopycinski
B.S., Lowell Textile Institute, 1948

Nallanna Lakshminarayanaiah
M.S., Benares Hindu University, 1945

Richard Edward Petersen
B.S., Lowell Textile Institute, 1947

Charles Russell Sheehan
B.S., Lowell Textile Institute, 1949

Charles Richard Trommer
B.S., Lowell Textile Institute, 1949

Hsuan Sun Wang
B.S., St. John's University, 1946

Master of Science in Textile Manufacturing

Peter Marion Kormos
B.S., Lowell Textile Institute, 1950

Ta Tung Kuo
B.S., Chen-Fu Textile College, 1943

David Herbert Pfister
B.S., Lowell Textile Institute, 1950

Evangelos James Stavrakas
B.S., Lowell Textile Institute, 1950

Eugene Oliver Alpert
B.A., Duke University, 1946

Master of Science in Textile Engineering

William Carter Barefield
B.S., Alabama Polytechnic Institute, 1931

Philip Crosby
B.S., United States Naval Academy, 1944

Kenneth William Longnecker
B.S., United States Naval Academy, 1944

John Joseph O'Neil, Jr.
B.S., Tufts College, 1947

Louie Willard Strum, Jr.
B.S., United States Naval Academy, 1940

Bachelor of Science in Textile Chemistry

Michael Maurice Besso
Burton Blagman
Paul Victor Boudreau
Edward Joseph Britton
*Judith Anne Brown
Norman Matthew Brunelle
Thomas Garret Casey
Therese Rita Commerford
Albert Raymond Copp
John Evans
Donald Pearson Feyler
Irving Wyman Feyler, Jr.
Walter Edwin Flister
Leo Peter Gaidis
John Russell Godet
A. Peter Gouveia
*Joan Louise Gregg
Stanley Joseph Grochmal
Raymond Earl Halligan
Frank Henry Hekker
*Frederick Matthew Hornyak
Daniel Theodore Koshak
Gabrielle Marie Lemire
Dorothy Anne McCarron
Malcolm McGowan
Herbert Francis Mahoney
Edward N. Manning
*Nathaniel Abraham Matlin
*James Edward Miller
Samuel Camillo Profio
William J. Reines
Charles Joseph Rodgers, Jr.
Stephen Clifford Ruffenach
*Herbert Joseph Smaha
George William Spicer
Richard Irving Strobel, Jr.
William Francis Welcome
Joseph Edward Weldon
*Allan Robert Wirth

Bachelor of Science in Textile Manufacturing

George Amos Abbott
*Gerardo R. Augsburger
Richard John Becker
*Bernard Samuel Book
Alanson W. Bowden, Jr.
Wendell Herbert Breck
Sidney Wallace Bressler
Walter Madison Brown
Sumner Ives Brownell
Alfred William Canova
*Fred Dolge Carter
John Gerard Casey
Claude Emmanuel Castoriano
Pei Chung Chao
Stanley Joseph Clifford
James Henry Derby
*Paul Dubin
Lawrence Francis Ellis
Glenn Robert Farley
Manuel David Feldman
Joseph Fishback
Frederick Jordan Fowle
Herbert Glassman
*Alfred Yale Goldman
Sumner Bernard Goldman
David Leonard Kaufman
Leonard Saunders Koffman
*Peter Marion Kormos
Stephen Gerard LaRiviere
*Donald Joseph Leitgeb
*Regina Mark McElrath
John Francis O'Donoghue, Jr.
*Alfred Ernest O'Krafka
*David Herbert Pfister
William Pong
*Raymond Elphege Proulx
John Dana Ramsbottom, Jr.
Elie Rivollier, Jr.
*Sidney Rudes
Robert Murray Sheroff
*Evangelos James Stavrakas
Charles Richard Weiner
Charles Andrew Whitehead
*John Woodburn Williams

Bachelor of Science in Textile Engineering

Kenneth Myron Adler
Hugh Hill Andrews
Paul Joseph Angelo, Jr.
Stephen Smith Callan
Bryant Locke Carpenter
Thomas Nielson Chadwick
Fur She Cheng
Robert Edward Cummings
Warren Dana Douglas
Robert Kimball Earls
Ralph Jefford Ellis
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Richard Tyler Fifield
Malcolm Graham Fillmore, Jr.
*Julius Ira Fox
Harry Gaon
Donald Ian Gellis
Arthur Marvin Glass
Morton Hacker
Erwin L. Herbert
William Eugene Higgins
Richard McClain King
Lufti Koksal
*Remo Joseph Laureti
Myer Lebowitz
Arthur David Levinson
Edward Lincoln Lord, Jr.
Peyton Conway March
James Francis Martin
Richard Morris Meltzer
Allen Robert Merrill
Donald Whiting Middleton
V. John Paul
John S. Peterson
Joseph Amos Priestley
Albert Samdperil
*William Stanley Shires
*Robert Hood Sloan
Ralph Frank Snow
Charles Squire
Frank Broneslaw Struzik
Paul Ashton Sweetser
Albert George West
Albert Thomas Woidzik
Mustafa Ekrem Yumlu

*Tau Epsilon Sigma (Textile Scholastic Society)

REGISTER OF STUDENTS

GRADUATE STUDENTS

BILBAO, BENJAMIN BAUTISTA, IV, Colombia, S. A.
B.S., Atlantic University, 1949

CALVO, JAIME SALAS, VI, Santiago, Chile
C. E., Universidad Católica de Chile, 1950

CASEY, THOMAS GARRETT, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1950

CHAO, PEI CHUNG, VI, Shanghai, China
B.S., Lowell Textile Institute, 1950

FEYLER, IRVING WYMAN, JR., IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1950

FISHBACK, JOSEPH, V, Belle Harbor, New York
B.S., Lowell Textile Institute, 1950

GAIDIS, LEO PETER, IV, Lawrence, Mass.
B.S., Lowell Textile Institute, 1950

GREEN, ARTHUR NORMAN, IV, Lowell, Mass.
B.S., Brown University, 1949

GREGG, JOAN LOUISE, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1950

HOBBS, ALFRED KEAN, VIII, New Rochelle, New York
B.S., University of Maine, 1950

HORWITCH, ARNOLD MURRAY, V, Chicago, Illinois
Ph.B., University of Chicago, 1948

JORDANIDES, GEORGE ALEX, VI, Athens, Greece
B.S., Bradford-Durfee Technical Institute, 1950

LORD, EDWIN LINCOLN, JR., VI, W. Medford, Mass.
B.S., Lowell Textile Institute, 1950

MATLIN, NATHANIEL ABRAHAM, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1950

NYSTROM, FREDERICK WALTER, VI, Lowell, Mass.
B.S., Lowell Textile Institute, 1949

O'DONOGHUE, JOHN FRANCIS, JR., V, Belmont, Mass.
B.S., Lowell Textile Institute, 1950

PATTON, GERALD JACKSON, SC, USN, VI, Anadarko, Oklahoma
B.S., U. S. Naval Academy, 1944

SKALKEAS, BASIL GEORGE, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1941

SMITH, JAMES AARON, SC, USN, VI, Norfolk, Va.
B.S., U. S. Naval Academy, 1944

*SUMERS, ROBERT WARREN, IV, San Diego, California

TENG, THOMAS CHIH-HSIUNG, V, Shanghai, China
A.B., Princeton University, 1950

WOO, HENRY KYI-OEN, VI, Shanghai, China
M.S., Lowell Textile Institute, 1948

YELENIDES, JORDAN PRODROMOS, VI, Athens, Greece
B.S., New Bedford Textile Institute, 1950

* Candidate for the degree of Bachelor of Science in Textile Chemistry, June, 1951.

OFFICERS TEXTILE TRAINING COURSE

Greene, Alfred Thomas, Lt. Col., USMC, VI, Pass-a-Grille Beach, Fla.
Colorado School of Mines

SPECIAL STUDENTS

Barrett, James Joseph, A.B., II .... Waban, Mass.
Brown, Edwin Kendrick, IV .... North Andover, Mass.
Cherry, Jay Leonard, A.B., II .... Swampscott, Mass.
Coakley, Frances Cooper, B.A., III .... Buffalo, N. Y.
Feyler, Donald Pearson, B.S., IV .... Chelmsford, Mass.
Gagnon, Arthur Joseph, Jr., II .... Woonsocket, R. I.
Hubbard, Edwin Lawrence, B.A., II .... Webster, Mass.
Hubbard, Elizabeth Jane, B.A., III .... Webster, Mass.
Kearney, George Vincent, Jr., II .... Ludlow, Vermont
Kempster, Nancy Laurel, III .... Wilmington, Mass.
Kundriat, Edward, II .... Garfield, New Jersey
Meehan, David Justin, I .... Providence, Rhode Island
Omizo, Hisao, B.C., VII .... Chiba Pref, Japan
Raynowska, Paul, A.B., VIII .... Methuen, Mass.
Reynolds, Charles Vaughn, Jr., B.S., II .... Canton, Mass.
Rubenstein, Louis Lee, VI .... New York, N. Y.
Scanlan, Joseph James, B.S., II .... Danbury, Connecticut
Trommer, Charles Richard, M.S., IV .... Lowell, Mass.
Wise, Jerold Israel, III .... Clifton, Mass.

UNDERGRADUATE STUDENTS

CLASS OF 1951

Abbot, Edward Moseley, Jr., II . . . . . Westford, Mass.
Abrahamson, David Marshall, III . . . . . Worcester, Mass.
Ames, Irwin Maxwell, VI . . . . . Brooklyn, N. Y.
Aronowitz, Marvin, VI . . . . . Patterson, N. J.
Arsham, Martin David, II . . . . . Cleveland Heights, Ohio
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Coombes, Richard William, VI . . . . . Tewksbury, Mass.
Corcoran, Henry James, Jr., II . . . . . Newton Lower Falls, Mass.
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Craven, Frank Joseph, IV . . . . . Lowell, Mass.
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Cushman, Paul Swan, VI . . . . . Glens Falls, N. Y.
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Davis, Evans Reade, VI . . . . . Toronto, Ontario
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Eidlitz, Thomas, III . . . . . New York, N. Y.
Eklund, Clinton Louis, VI . . . . . Lowell, Mass.
Feitelson, Herbert William, VII . . . . . New York, N. Y.
Ferron, Richard Edward, VI . . . . . Everett, Mass.
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Glidden, John Edwin, II . . . . . Ashland, N. H.
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Goodwin, Dorrance Haven, VI . . . . . Sanford, Maine
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Halpern, Melvin Arthur, VI . . . . . New York, N. Y.
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Holmberg, Harry Harmon, V . . . . . Milford, Mass.
Jackle, Roger Williams, II . . . . . Springfield Gardens, N. Y.
Karpoff, David, II . . . . . New York, New York
Keith, Richard Canover, II . . . . . Putnam, Conn.
Kelleher, John James, IV . . . . . Lowell, Mass.
Kelley, Edward Francis, II . . . . . No. Billerica, Mass.
Knight, John Henry, II . . . . . Billerica, Mass.
Kohnfelder, Charles Harry, VI . . . . . Lowell, Mass.
Kosowicz, Walter John, IV . . . . . Lowell, Mass.
Labrecque, Leo Eugene, IV . . . . . Lawrence, Mass.
Landis, Melvin Bernard, VI . . . . . Springfield, Mass.
Lawson, Wayne Herbert, IV . . . . . Tewksbury, Mass.
Levenson, Albert Milton, IV . . . . . Mattapan, Mass.
Levy, Simon, V . . . . . Brooklyn, N. Y.
Linberg, Charles Francis, VI . . . . . Carney's Point, N. J.
Little, Charles Abbott, III . . . . . Winthrop, Mass.
Luba, Marvin, VII . . . . . Bronx, N. Y.
Lyons, Allan Stuart, VII . . . . . New York, N. Y.
McKone, Henry James, VI . . . . . Lowell, Mass.
McKone, Thomas Joseph, IV . . . . . Dracut, Mass.
Maguire, Thomas Joseph, VI . . . . . Lowell, Mass.
Majeune, Gaston Christian, IV . . . . . Haverhill, Mass.
Menzies, William Cornet, Jr., VI . . . . . Adams, Mass.
Merrill, Kenneth Stephen, VI . . . . . Lowell, Mass.
Miller, Arthur Paul, VI . . . . . Salt Lake City, Utah
Miller, Kenneth Edward, II . . . . . Lawrence, Mass.
Monaco, Albert Thomas, VI . . . . . Lowell, Mass.
Morris, Edward Sharon, III . . . . . Paterson, N. J.
Morrison, Robert Eugene, IV . . . . . Dracut, Mass.
Murmes, Leonard, II . . . . . Brighton, Mass.
Murphy, Roger James, VI . . . . . N. Uxbridge, Mass.
Needle, Irwin Reuben, III . . . . . Brooklyn, N. Y.
Newell, Kenneth Bernard, VI . . . . . Troy, N. Y.
Newman, Jerome Leonard, VI . . . . . Elmhurst, Queens, N. Y.
Nickerson, Earl James, V . . . . . Chelmsford, Mass.
Noonan, Joseph Donald, IV . . . . . Lowell, Mass.
O'Donnell, William Robert, VI . . . . . Lowell, Mass.
Pantell, Ira Harry, III . . . . . New York, N. Y.
Panto, Joseph Salvatore, IV . . . . . Lawrence, Mass.
Patrick, Kit Carson, III . . . . . Andover, Mass.
Pelliccione, Gregory Joseph, IV . . . . . Lawrence, Mass.
Pihl, Donald Greenwood, VI . . . . . Lowell, Mass.
Pofcher, Wilmer, III . . . . . Lowell, Mass.
Quinn, Raymond John, IV . . . . . Lowell, Mass.
Rawitz, Leonard, VII . . . . . Lowell, Mass.
Rebenfeld, Ludwig, IV . . . . . Lowell, Mass.
Reilly, Frank Thomas, I . . . . . Maplewood, N. J.
Richard, Alfred Joseph, IV . . . . . Gardner, Mass.
Richardson, Donald Forrest, VI . . . . . Lowell, Mass.
Roberts, Richard Seymour, VI . . . . . Brooklyn, N. Y.
Robson, Daniel Riggs, III . . . . . Lowell, Mass.
Rostler, Seymour Stone, VII . . . . . Lowell, Mass.

Rosenkrantz, Stanley, I . . . . . Pottsville, Pa.
Rowe, Peter Marcel, III . . . . . Paterson, N. J.
Ryan, Lawrence Francis, Jr., VI . . . . . Carney's Point, N. J.
Ryan, William Eugene, VII . . . . . Rankin, Ill.
Salomon, Jay Stuart, VI . . . . . Brooklyn, N. Y.
Schlaginhaufen, Eric Alan, IV . . . . . North Bergen, N. J.
Schrager, Jerome Stanley, V . . . . . Brooklyn, N. Y.
Seigel, Hersch David, II . . . . . Brookline, Mass.
Shapley, Harvey David, I . . . . . Great Neck, N. Y.
Shaughnessy, Robert Kenton, IV . . . . . Lowell, Mass.
Shenkar, Shmaryahu B., VI . . . . . Tel-Aviv, Israel
Sherburne, Edwin Collier, IV . . . . . Tyngsboro, Mass.
Sheroff, Melvin Saul, II . . . . . Dorchester, Mass.
Silver, Bernard, III . . . . . Worcester, Mass.
Socransky, Morris Harvey, II . . . . . Montreal, Quebec
Solov, Leonard, II . . . . . Newton Center, Mass.
Spencer, Robert Weeks, II . . . . . Saylesville, R. I.
Stein, Alfred Eugene, VII . . . . . Astoria, L. I., N. Y.
Sternlieb, Herschel, V . . . . . Brookline, Mass.
Sumers, Robert Warren, IV . . . . . San Diego, California
Swiatek, Henry John, IV . . . . . Methuen, Mass.
Teta, Walter Michael, III . . . . . Brooklyn, N. Y.
Teubal, Michael Neville, II . . . . . Buenos Aires, Argentina
Trilling, Theodore Roosevelt, Jr., II . . . . . Woodmere, N. Y.
Tully, Frank Paul, IV . . . . . Lowell, Mass.
Tully, Paul Raymond, IV . . . . . Lowell, Mass.
Vyas, Nath Mal, II . . . . . Bikaner, India
Wang, James Paul, I . . . . . Shanghai, China
Weldon, Arthur Joseph, VI . . . . . Lowell, Mass.
Whitney, Kenneth Lincoln, II . . . . . Pittsfield, Mass.
Whitworth, James Webster, IV . . . . . Chelmsford, Mass.
Wiener, Donald, IV . . . . . New Britain Conn.
Wilkinson, John Stewart, VI . . . . . North Andover, Mass.
Wood, Samuel Anthony, IV . . . . . North Adams, Mass.

CLASS OF 1952

Aelion, David Leon, VI . . . . . Alexandria, Egypt
Aldrich, Donald Winthrop, III . . . . . No. Tewksbury, Mass.
Allen, Curtis Carleton, II . . . . . Milton, Mass.
Allison, John Harold, VI . . . . . No. Andover, Mass.
Aptaker, Erwin Malcolm, VII . . . . . Revere, Mass.
Aronson, Richard Lee, V . . . . . Great Neck, N. Y.
Axon, Gordon Lysle, IV . . . . . Chelmsford, Mass.
Barr, Robert Sutherland, VI . . . . . Amesbury, Mass.
Barry, Gerald Francis, IV . . . . . Lowell, Mass.
Beaulier, Vernon, James, VIII . . . . . Lowell, Mass.
Becker, Marvin Franklin, V . . . . . Brooklyn, N. Y.
Becker, Robert Ivan, VI . . . . . Leicester, Mass.
Belanger, Wilfred Edmond, IV . . . . . Lowell, Mass.
Bell, Gilbert Carter, VI . . . . . Lowell, Mass.
Benjamin, Albert, III . . . . . Brooklyn, N. Y.
Bernstein, Milton, Jacob, III . . . . . Paterson, N. J.
Bird, Marshall Coles, II . . . . . Rochester, N. H.
Bloch, Manfred Gunter, VI . . . . . Tel-Aviv, Israel
Boches, Milton, IV . . . . . Lowell, Mass.
Bodor, Stephen, Joseph, VI . . . . . Lynn, Mass.
Brissette, Richard Stacy, VI . . . . . Rockford, Ill.

Bromley, John Eberbach, VI .... Glenside, Pa.
Brown, Perry Horton, VI .... Marblehead, Mass.
Bussiere, Kirk, III .... Needham, Mass.
Carroll, William Henry, III .... Medford, Mass.
Claridge, Arthur Whittier, VI .... Marlboro, Mass.
Coffin, Laurance Gregory, VI .... Port Chester, N. Y.
Delaney, Francis L., VI .... Forge Village, Mass.
Desrochers, Roland Joseph, VI .... Franklin, N. H.
Dersh, Harvey Arthur, VI .... Brooklyn, N. Y.
Dickison, Bruce Osborne, IV .... Lowell, Mass.
Dole, Gordon, Shattuck, VI .... Bristol, N. H.
Donoian, Haig, Cadmus, IV .... Lowell, Mass.
Dooley, Donald David, IV .... Lowell, Mass.
Draper, Richard Leonard, I .... Hopedale, Mass.
Eklund Richard Thorp, IV .... Lowell, Mass.
Engelhardt, Bernard Herbert, VI .... Brooklyn, N. Y.
Feinberg, Bertram, III .... Forest Hills, N. Y.
Finegold, Donald Erwin, IX .... Peabody, Mass.
Fulginiti, Panteleone, Samuel, VI .... Worcester, Mass.
Galas, Albion Henry, VI .... Monson, Mass.
Giard, Edward Henry, IV .... Black Mountain, N. C.
Girard, Roger Donald, V .... Lowell, Mass.
Gladstone, Milton Harvey, V .... Brooklyn, N. Y.
Goven, Earl Joseph, I .... Wauregan, Conn.
Grady, Douglas Francis, I .... Palisades Park, N. J.
Graham, Everett H., VI .... Graniteville, Mass.
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Grill, Joel Harvey, VI .... Brooklyn, N. Y.
Hausman, Richard Demaret, V, ... Kings Point, L. I., N. Y.
Haddad, Herbert Lawrence, VI .... Iselin, N. J.
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Hochfeld, Michael, IV .... Bronx, N. Y.
Hochner, Walter Leo, IV .... Kew Gardens, N. Y.
Hocking, Winfred Thomas, VI .... Lowell, Mass.
Johnson, Paul Lester, VI .... Lowell, Mass.
Jouret, John Edward, II .... Andover, Mass.
Kalantzakos, Nicholas, VI .... Lowell, Mass.
Kaye, Irwin, VII .... Brookline, Mass.
Kaye, Michael Bondy, V .... New York, N. Y.
Keenan, Ursula, Frances, III .... So. Boston, Mass.
Komins, Burton Louis, IV .... Brookline, Mass.
Koza, Walter Mitchell, VIE .... Lowell, Mass.
Kupferman, Arthur, VII .... Bronx, N. Y.
Lanciault, George Ernest, IV .... Ware, Mass.
Langlais, Roger John, IV .... Lowell, Mass.
LaPlante, Richard Haynes, IV .... Lowell, Mass.
Lee, Laurence, Chih-liang, I .... Shanghai, China
Lein, Sherman, IV .... Brooklyn, N. Y.
Lemire, John Emile, II .... Lowell, Mass.
Levenson, Richard Norman, VII .... Brookline, Mass.
Lewis, Francis, Augustus, VI .... Dedham, Mass.
Lewis, Roger Alan, VI .... Chelmsford, Mass.
Liacopoulos, Nicholas Constantine, VI .... Lowell, Mass.
Liston, Florence Patricia, IV .... Lowell, Mass.
Longbottom, Parker Wyman, IV .... Claremont, N. H.
Lynch, William Paul, VI .... Lowell, Mass.
MacLean, Harold John, VI .... Lowell, Mass.

McEwen, Thomas Arthur, II .... Webster, Mass.
McCartney, Donald James, IV .... Lowell, Mass.
McKeon, Richard Francis, VI .... No. Adams, Mass.
McNulty, Denis, Michael, II .... Dorchester, Mass.
Mack, Charles Harris, VII .... Cape Elizabeth, Me.
Mettler, Edward, VI .... Forest Hills, L. I., N. Y.
Michaels, Charles Sylvester, II .... N. Bellingham, Mass.
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Montgomery, Richard H., VI .... Chelmsford, Mass.
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Rutledge, Robert John, Jr., VI .... Lowell, Mass.
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Tosone, Mario Carmen, IV .... Lawrence, Mass.
Traversy, Adolphe Arthur, IV .... Lowell, Mass.
Travis, Lazarus, V, ... Brookline, Mass.
Tung, Cheng-Yu, I .... Shanghai, China
Wasserman, Bernard, VII .... Providence, R. I.
Watt, Charles Edward, Jr., VI .... Chelmsford, Mass.
Winn, Irving Woodman, Jr., I .... Lisbon Falls, Me.
Wise, Ralph LeRoy, IV .... Lowell, Mass.
Wood, Eugene Jackson, Jr., VI .... Westford, Mass.
Zoglio, Eleanor Barbara, IV .... Lawrence, Mass.

CLASS OF 1953

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Arnold, Edward, IV . . . . Revere, Mass.
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Baxter, George Lytton, IV . . . . Briarcliff, N. Y.
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Brody, Arnold Allan, VI . . . . Brooklyn, N. Y.
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Cross, Robert James, VI . . . . Westford, Mass.
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Demas, Harry John, IV . . . . Athens, Greece
Devereaux, John Lawrence, II . . . . W. Roxbury, Mass.
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McKniff, Francis, V . . . . Forge Village, Mass.
MacLellan, Neil, Jr., II . . . . Larchmont, N. Y.
McSheehy, Robert Wilder, II . . . . Worcester, Mass.
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Magnant, Alfred Joseph, VI . . . . Rye, N. Y.
Mann, Ellsworth George, Jr., VI . . . . Ridgewood, N. J.
Mann, Warren Eugene, VI . . . . Troy, N. Y.
Mulcahy, Robert Edward, V . . . . Arlington, Mass.
Nachman, Steven Gunther, II . . . . Kew Gardens, N. Y.
Nelligan, James Anthony, V . . . . Lowell, Mass.
Nordon, Franklin A., VI . . . . Medford, Mass.
Norman, William Arthur, VI . . . . Hopedale, Mass.
Nuzzolo, John Vincent, IV . . . . Derby, Conn.
Ostrove, Donald Martin, VII . . . . Long Beach, N. Y.
Paris, Irin Myron, III . . . . FairLawn, New Jersey
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Profio, Robert Michael, IV . . . . Lowell, Mass.
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Swanson, Morris Harvey, VI . . . . Westford, Mass.

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Vaillancourt, Paul Joseph, V . . . . . Lowell, Mass.
Velantzas, James Anastas, IV . . . . . Lowell, Mass.
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Wark, Donald Thomas, IV . . . . . Westford, Mass.
Wattles, Benjamin, VI . . . . . Canton, Mass.
Wiener, Melvin, V . . . . . Brooklyn, N. Y.
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Wuester, Erwin August, III . . . . . Riverdale, N. J.
Zagel, Itzhak, VI . . . . . Tel-Aviv, Israel

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Baevsky, Marvin Arthur, VI . . . . . Springfield, Mass.
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Cassidy, Robert Thomas, VI . . . . . Lowell, Mass.
Cate, Alan Clifford, VI . . . . . Lawrence, Mass.
Chan, Billings Ka-Yik, I . . . . . Hong Kong, China
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Cohen, Herbert Lenord, VII . . . . . Jamaica, Long Island, N. Y.
Cohen, Ronald A., IV . . . . . Lowell, Mass.
Cole, Franklin Bruce, III . . . . . Auburn, Maine
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Conley, John Theodore, I . . . . . Warren, Rhode Island
Cryan, Arthur Philip, Jr., VIII . . . . . Lowell, Mass.
Dantos, Phidias George, III . . . . . Andover, Mass.
De la Mora, Guillermo, VI . . . . . Mexico City, Mexico
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Donnelly, Edwin J., VIII . . . . . Falmouth, Mass.
Dooley, William Eugene, IX . . . . . Lowell, Mass.
Doull, Donald John, III . . . . . Dedham, Mass.
Doyle, Russell Paul, IX . . . . . Lowell, Mass.
Driscoll, Gerard Horace, VI . . . . . Tyngsboro, Mass.
Ducharme, Jean-Charles, VI . . . . . Orleans, Mass.
Emery, Ronald Irvin, VI . . . . . Winthrop, Me.
Ettenson, Melvin Walter, VI . . . . . Elmont, New York
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Ferenbach, John C., Jr., V . . . . . Kingston, Pa.
Flint, Harry Edwin, VI . . . . . Lawrence, Mass.
Foley, William Mark, VI . . . . . Lowell, Mass.
French, Kenneth Allan, VI . . . . . Franklin, N. H.

Fulton, Robert Fraser, IX . . . . . Lowell, Mass.
Gabriel, William George, VII . . . . . Flushing, N. Y.
Gagnon, Rene Jerome, VI . . . . . Pawtucket, R. I.
Gagnon, Roger Albert, IV . . . . . Lowell, Mass.
Garrett, Owen Loran, VI . . . . . Lowell, Mass.
Garvey, Thomas Francis, IV . . . . . Lowell, Mass.
Genereux, Albert Joseph, VI . . . . . Webster, Mass.
Gilet, Alrert J., Jr., VI . . . . . Lowell, Mass.
Gillie, Stanley, James, VI . . . . . Foxboro, Mass.
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Higgins, Charles James, VIII . . . . . Lowell, Mass.
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Horowitz, I. Laurence, VI . . . . . Brooklyn, N. Y.
Iannazzi, Joseph Louis, VI . . . . . Lawrence, Mass.
Kao, Victor T. C., VI . . . . . Shanghai, China
Kennedy, William James, Jr., IV . . . . . So. Hadley Falls, Mass.
Kerkhof, John Francis, VIII . . . . . Mendon, Mass.
Kezar, Richard Frank, IV . . . . . Groton, Mass.
Kiluk, Frank John, IV . . . . . Lowell, Mass.
Kimmell, Arnold Lawrence, VI . . . . . Westfield, Mass.
Kinney, Georgina Betty, IV . . . . . Lowell, Mass.
Krysiak, Edward Francis, VI . . . . . Lowell, Mass.
Kupferschmid, Bernardo, VI . . . . . Buenos Aires, Argentina
Kyriacopoulos, Vasilios, VI . . . . . Lowell, Mass.
Lanthier, Paul Francis, IV . . . . . Dracut, Mass.
Laurin, Lloyd Strowburg, IX . . . . . Lowell, Mass.
Laurion, Tristan Arnold, IV . . . . . Dracut, Mass.
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Legge, Robert Wayne, IV . . . . . N. Easton, Mass.
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Marchand, Albert Joseph, IX . . . . . Lowell, Mass.
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Rushton, Warren Stanley, VIII . . . . Lowell, Mass.
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Whitney, Lloyd, Elmore, VI . . . . Brockton, Mass.
Zacks, Leo Levy, VII . . . . Fall River, Mass.
Zalechowski, Edwin, IV . . . . Lawrence, Mass.

SERIES 55, NO. 1
CURRICULUM BULLETIN

August, 1951

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

1951 - 1952

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Textile and Colonial Avenue

DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

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CALENDAR — 1951

September 27, 7-8:30 P.M.	Registration
October 2, 4 and 9, 7-8:30 P.M.	Registration
October 15, Monday	Opening of Evening School
November 21 and 22, Wednesday and Thursday	Thanksgiving Recess
December 24, Monday	Christmas Recess begins

1952

January 7, Monday	Classes resume
March 13, Thursday	Evening classes end

GENERAL INFORMATION

Entrance Requirements

Entrance requirements vary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Lowell Evening Textile School, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Textile School, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering on the evenings set aside for that purpose.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules.)

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

A registration fee of one dollar is required of *all* students, in addition to tuition and other charges.

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell. However, registration may be completed prior to filing this certificate with the office.

To non-residents the tuition fees are as follows:

One evening per week courses	$ 5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course must make a laboratory deposit of $10. Those electing Machine Shop Practice must make a laboratory deposit of $5. This is to cover supplies and breakage and any unexpended balance at the end of the year will be returned to the student. These laboratory deposit provisions apply to both residents and non-residents of Lowell.

Regularly enrolled day school students at Lowell Textile Institute may take evening courses without charge for tuition, but are required to pay the one dollar registration fee and make the laboratory deposit where the latter is required.

All fees and deposits are payable in advance.

Refunds

Students dropping out of a course any time before the end of the first ten weeks may obtain a refund of one-half their tuition, provided application is made prior to the expiration of the first ten weeks. Unused portions of laboratory deposits will be refunded only at the end of the course. No refund of tuition will be made after the first ten weeks. The registration fee of one dollar will not be returned in any case unless the course is cancelled.

Late Registration

No registration for any course will be accepted after the first three weeks of classes in that course.

Veterans

All Lowell Evening Textile School courses are approved for study under the G. I. Bill of Rights. Those still entitled should secure a certificate of eligibility from the Veterans' Administration before registering. Books and supplies can not be obtained without it. A letter from the Veterans' Administration showing application for a certificate has been made will be accepted for temporary admission to classes but must be followed by a certificate of eligibility or tuition charges will be made. Veterans who have been pursuing a course of study at the Lowell Evening Textile School under its provisions may complete their program subject to V. A. regulations.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6.45 to 8.15 P.M.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

Inclement Weather

Due to difficulties in notifying in time students and instructors who reside at a distance, evening school will not be cancelled for reasons of weather at any time.

Attendance

Students must attend 70% of all classes held in a course in order to receive credit for the course. Four unexplained absences in a row will result in the student being automatically dropped from the rolls.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing courses on following pages.)

The diploma of the Lowell Evening Textile School will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for five or six years. At present diploma courses are being offered in Analytical Chemistry(six years), Textile Chemistry and Dyeing (five years), Cotton Manufacturing (six years), Woolen Manufacturing (five years) and Worsted Manufacturing (six years).

The diploma courses were initiated in 1947 and, as yet, their content is tentative and subject to change. The Institute expressly reserves the right to alter or change them in scope and content as it deems advisable. In general, however, they should not differ materially from the programs shown.

All students working toward a diploma should contact the director of evening school as soon as possible to work out a schedule of courses suitable to their objective.

COTTON DEPARTMENT

Staff

Prof. Gilbert R. Merrill, B.T.E., in charge of department
Assoc. Prof. Nathaniel E. Jones
Asst. Prof. John A. Goodwin, B.T.E.
Mr. Clarence J. Pope, B.S.
Mr. Ferrell G. Kent

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Cotton Yarns	101-A		X		X	None
Cotton Yarns	101-B	X		X		101-A
Cotton Yarns	101-C	X		X		101-B
Knitting	113		X		X	None

Description of the Above Courses

101-A *Cotton Yarns.* First year of cotton yarn manufacture. Topics covered include: properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, and carding. Lecture and laboratory.

101-B *Cotton Yarns.* Second year of cotton yarn manufacture. Topics covered include: combing, drawing, regular and long draft roving. Lecture and laboratory.

101-C *Cotton Yarns.* Third year of cotton yarn manufacture. Topics covered include: spinning, spooling, winding and twisting. Lecture and laboratory.

113 *Knitting.* A general course in the manufacture of knitted fabrics and garments. It includes yarns and yarn sizing.

Certificates

The certificate of the school will be awarded for completion of the three-year course in cotton yarns, 101-A, 101-B and 101-C. A certificate will also be awarded for the completion of 113.

Diploma in Cotton Manufacturing

A diploma in cotton manufacturing will be awarded to those completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work towards an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to schedule in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

While the work load in individual years will vary, a student could expect to complete this program in six years if he attends an average of three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

The minimum requirement for the diploma in Cotton Manufacturing is a total of 720 classroom hours or an average of three evenings per week for six years.

The following courses must be taken:

Cotton Yarns 101-A, 101-B and 101-C; Weave Formations 301-A; Yarn Calculations 301-B; Cotton Design 327 and 328; Power Weaving 332; Cotton Finishing Survey 718; Textile Testing; 671.

The above courses total 520 classroom hours. The remaining 200 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Power Weaving 333, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630, and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

WOOLEN AND WORSTED DEPARTMENT

Staff

Prof. James H. Kennedy, Jr., B.T.E., M.S., in charge of department
Asst. Prof. J. Frederic Burtt, B.T.E.
Asst. Prof. Michael J. Koroskys
Mr. Russell L. Brown, Jr., B.S.
Mr. James T. Simpson

SUBJECT and NUMBER		EVENINGS *Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Technology of Fibers and Yarns	202			X		None
Woolen Yarns	203	X	X			601
Top Making	204	X				601
Bradford Yarns	205			X		601
French Yarns	206	X	X			601
Textile Mechanism & Calculations	601				X	None

Description of Above Courses

202 *Technology of Fibers and Yarns.* Types of sheep and wool. Wool buying, selling, grading, sorting, scouring, stock carbonizing. Mohair, alpaca, camel hair, etc. Theory and principles of yarn making by all systems. Roller drawing, spindle drawing, porcupine. Mostly lectures, some laboratory demonstrations.

203 *Woolen Yarns.* Fiber blending, oiling, picking, woolen carding, mule and frame spinning, twisting. Reprocessed and reused fiber preparation from rags to fiber ready for carding. Mostly lectures, some laboratory demonstrations.

204 *Top Making.* Worsted carding, backwashing, open gilling, Noble combing. Specifications and analyses of standard tops, Warner Swasey Pin Drafter, Pacific Converter, Perlok System. Mostly lectures, some laboratory demonstrations.

205 *Bradford Yarns.* Worsted drawing, spinning, and twisting on English system machinery. The newer short-cut systems using the Warner Swasey Pin Drafter. Mostly lectures, some laboratory demonstrations.

206 *French Yarns.* French combing, intersecting gilling, blending, French system worsted, drawing, spinning, and twisting. Mostly lectures, some laboratory demonstrations.

601 *Textile Mechanism and Calculation.* A short course covering the necessary mechanism, physics and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers, cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is designed to be taken simultaneously with the courses for which it is a prerequisite.

Certificates

The certificate of the school will be awarded for the following group of courses:

Woolen Yarn Certificate—	For completion of courses 601, 202, 203.
Top Making Certificate—	For completion of courses 601, 202, 204.
Bradford Worsted Certificate—	For completion of courses 601, 202, 204, 205.
French Worsted Certificate—	For completion of courses 601, 202, 204, 206.

Diplomas

A diploma in woolen or worsted manufacture will be awarded to students completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work toward an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to take in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

These courses will give the necessary background for the operation of a woolen or worsted mill and are designed for the student who wishes to prepare himself for the higher supervisory and executive positions

The minimum requirement for the diploma in either woolen or worsted manufacture is a total of 720 classroom hours or an average of three evenings per week for six years.

For a diploma in woolen manufacture the following courses must be taken:

Technology of Fibers and Yarns 202, Woolen Yarns 203, Textile Mechanism and Calculations 601, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Fnishing 710, and Textile Testing, 671.

The above courses total 520 classroom hours. The remaining 200 hours that are required may be elected by the student from the two groups of subjects listed after the requirements for the diploma in worsted manufacture. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

For a diploma in worsted manufacture the following courses are required:

Technology of Fibers and Yarns 202, Top Making 204, Textile Mechanism and Calculations 601, Bradford Yarns 205, French Yarns 206, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Finishing 710 and Textile Testing, 671.

The above courses total 600 classroom hours. The remaining 120 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630 and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

TEXTILE DESIGN AND WEAVING DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Assoc. Prof. Russell M. Fox
Asst. Prof. Martin J. Hoellrich
Asst. Prof. John L. Merrill, B.T.E.
Asst. Prof. Edward L. Golec
Mrs. Lucy R. Weinbeck, B.T.E.
Mr. Albert T. Woidzik, B.S.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Weave Formations (First 10 weeks only)	301-A			X		None
Yarn Calculations (First 10 weeks only)	301-B	X				None
Cotton Design (Second 10 weeks only)	327	X		X		301-A, 301-B
Cotton Design	328		X		X	327
Woolen Design (Second 10 weeks only)	329	X		X		301-A, 301-B
Woolen & Worsted Design	330	X		X		329
Synthetic Design (Second 10 weeks only)	325-A	X		X		301-A, 301-B
Synthetic Design	325-B		X		X	325-A
Fabric Identification (Second 10 weeks only)	331		X		X	301-A
Power Weaving (First 10 weeks only)	332		X		X	None
Power Weaving	333	X		X		None
Loom Fixing‡	324		X		X	333

‡ Loom Fixing may be taken without 333 provided sufficient work has been done by the student in industrial weaving.

Description of the Above Courses

301-A *Weave Formations.* This subject covers weaves of all types from the plain weave through fancy and figured weaves. Harness draft and chain are worked out for each weave.

301-B *Yarn Calculations.* Yarn counts for all systems, including ply and fancy yarns, are covered.

327 *Cotton Design.* Cotton cloth analysis and design are studied, beginning with plain fabrics and leading into the more fancy dobbies.

328 *Cotton Design.* The design of more elaborate cotton fabrics is taken up such as filling backed, warp backed, ply, velvet, leno, etc.

329 *Woolen Design.* Cloth analysis and design covering blankets, bath robing, filling reversibles, extra warp and filling backs, figured effects, double cloths and plaid back.

330 *Woolen and Worsted Design.* This subject includes the more complicated fabrics some of which are chinchilla, melton, kersey as well as suitings. Costs for woolen and worsted fabrics are also covered.

325-A *Synthetic Design.* Cloth analysis and design of synthetic fabrics, including both filament and spun yarns.

325-B *Synthetic Design.* A continuation of 325-A covering the more fancy and complicated types of synthetics.

331 *Fabric Identification.* An elementary course in fabrics for those not specializing in industrial work, such as retail clerks, home economics students, etc.

332 *Power Weaving.* Warp preparation in all systems is covered as well as the Draper and Stafford automatic looms. Lecture and laboratory.

333 *Power Weaving.* More complicated looms are studied including dobby and Crompton & Knowles looms. Primarily woolen and worsted weaving. Lecture and laboratory.

324 *Loom Fixing.* The timing of all different motions in the loom and remedies for improper settings are covered. Box and harness chain planning and building are included. Lecture and laboratory.

Certificates

The cotton design certificate will be awarded for completion of 301-A, 301-B, 327, and 328.

The woolen and worsted design certificate will be awarded for completion of 301-A, 301-B, 329 and 330.

The synthetic design certificate will be awarded for the completion of 301-A, 301-B, 325-A and 325-B.

The loom fixing certificate will be awarded for the completion of 324.

The weaving certificate will be awarded for the completion of 333.

ART DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Mr. Elbert G. Bowring
Mrs. Helen Chace
Mrs. William Kaknes
Mrs. Mary S. Kiernan
Mr. Irwin Laurencelle
Miss Ruth Munson
Miss Antoinette Nault
Miss Arlene Redmond
Mr. John F. Vaughan
Miss Electra Vlahos

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Freehand Drawing	313-A					
Section 1		X		X		None
Section II			X		X	None
Pastel Drawing	334		X		X	313-A
Life Drawing	313-B	X		X		313-A
Silk Screen Printing	326		X		X	None
Show Card Design	314-A	X		X		None
Costume Design	335		X		X	None

Description of the Above Courses

313-A *Freehand Drawing.* Drawing in charcoal from casts and group arrangements of still life. Both sections cover the same material.

334 *Pastel Drawing.* Drawing in pastel from still life group arrangements.

313-B *Life Drawing.* Drawing from the live model in charcoal or in pastel. Individual and class instruction in anatomy.

326 *Silk Screen Printing.* This course covers the stencilling and printing on textiles and paper with the silk screen.

314-A *Show Card Design.* Pencil drawing of the alphabet and simple layouts of card signs executed in tempera paints.

335 *Costume Design.* How to alter the commercial garment pattern to suit the requirements of any figure.

Certificates

A one-year certificate will be awarded for the completion of any of the above courses.

The three-year art certificate previously awarded will still be available for those who commenced their work prior to 1949-50.

CHEMISTRY DEPARTMENT

Staff

Prof. Elmer E. Fickett, B.S., in charge of department
Assoc. Prof. John H. Skinkle, S.B., M.S.
Assoc. Prof. William G. Chace, Ph.B., M.S.
Asst. Prof. Charles L. Daley, B.T.C.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Professor John J. McDonald, B.T.C.
Asst. Prof. Ernest P. James, B.T.C., M.S.
Mr. Thomas F. Kelley, Jr., B.S.
Mr. Vasilis Lavrakas, B.S., M.S.
Mr. Walter J. Lisien, B.T.C.
Mr. Joseph B. Masaschi, B.T.C., M.S.
Mr. Ray E. MacAusland
Mr. Herman Brown, B.S.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
General Chemistry	411-A		X	X	X	None
General Chemistry	411-B	X		X	X	411-A
Qualitative Analysis & Stoichiometry	411-C	X		X	X	411-B
Quantitative Analysis & Stoichiometry	413-A	X	X		X	411-C
Quantitative Analysis & Stoichiometry	413-B	X	X		X	413-A
Quantitative Analysis & Stoichiometry	413-C	X	X		X	413-B
Textile Chemistry & Dyeing	412-A	X	X		X	411-B
Textile Chemistry & Dyeing	412-B	X	X		X	412-A
Textile Chemistry & Dyeing	412-C	X	X		X	412-B
Organic Chemistry (First 10 weeks only)	417	X			X	411-B
Physical Chemistry	421		X		X	413-C
Physical Chemistry* Laboratory	421-A			X		421
Chemical Engineering	431	X				See course description

Description of the Above Courses

411-A *General Chemistry.* For those with no previous knowledge of chemistry. This course covers the basic principles of inorganic chemistry including the fundamental chemistry law; the preparation, properties, and uses of metals, non-metals and related compounds; and simple chemical calculations. Lectures and laboratory. Two lectures, 7-9:30 P.M., one laboratory, 6:30-9:30 P.M., per week.

411-B *General Chemistry.* A course in elementary chemistry of college grade, open to those who have passed 411-A or a satisfactory course in high school chemistry. Emphasis is on the laws and theories of inorganic chemistry. Text—"General Chemistry" by Timin. Two lectures, 7-9:30 P.M., one laboratory, 6:30-9:30 P.M., per week.

411-C *Qualitative Analysis and Stoichiometry.* A basic course in the systematic analysis of inorganic compounds, carried out by the student in the lab. Chemical calculations and the balancing of chemical equations are covered

* Not offered in 1951-52.

in the stoichiometry portion of the course. One lecture, 7-9:30 P.M., two laboratories, 6:30-9:30 P.M., per week.

413-A, 413-B, 413-C *Quantitative Analysis and Stoichiometry.* The first two years of this three-year course cover the underlying principles of gravimetric and volumetric analysis, with sufficient laboratory work to enable the student to become proficient in performing routine analysis. The third year consists in the analysis of water, soap, oils, coal and other materials of interest to the textile chemist. One lecture, 7-9 P.M., two laboratories, 6:30-9:30 P.M., per week.

412-A, 412-B, 412-C *Textile Chemistry and Dyeing.* This course covers three years work of lectures and laboratory in the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of the fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic, and union materials. Organic chemistry and the technology of fibers are covered in the first year's lecture. One lecture, 7-9 P.M., two laboratories, 7-9 P.M., per week.

417 *Organic Chemistry.* A study of the important classes of carbon compounds and the fundamental theories of organic chemistry. Two lectures, 7-9 P.M.

421 *Physical Chemistry.* An elementary course in physical chemistry designed for the man in the laboratory or in industry. It includes a discussion of properties of gases, liquids, solids and solutions, chemical equilibrium, phase equilibrium, thermochemistry, electrochemistry and other topics according to the need of the students. Text used is "Physical Chemistry" by Bucher. This course is given alternate years with Physical Chemistry Laboratory. Two lectures per week, 7-9 P.M.

421-A *Physical Chemistry Laboratory.* Practice in the use of the methods and apparatus of physical chemistry. Includes measurement of vapor pressure, viscosity, surface tension, heat of combustion and reaction, pH by several methods and conductivity. Methods of determining molecular weight, distribution constant and calibration of apparatus are also included. Manual used is "Physico-Chemical Experiments" by Livingston. One laboratory per week, 6:30-9:30 P.M.

431 *Chemical Engineering.* Some important operations in chemical manufacturing, e.g., sulfuric acid production, will be surveyed from the standpoint of application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Flow of fluids, heat transfer, diffusional processes with particular reference to humidification, dehumidification and drying will be covered from the standpoint of the textile, leather and paper trades. The unit operations of distillation, filtration, absorption and extraction will also be studied.

This course is a graduate level course and carries credit for the M.S. degree at Lowell Textile Institute. Prerequisites are differential and integral calculus and two to three years of college chemistry including physical chemistry.

Diplomas

A diploma in Analytical Chemistry will be awarded for the successful completion of courses 411-A, 411-B, 411-C, 413-A, 413-B, and 413-C. This normally takes six years of three evenings per week.

A diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of courses 411-A, 411-B, 412-A, 412-B, and 412-C. This normally takes five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses and will be accepted for day school credit towards the B.S. degree of the Lowell Textile Institute.

Certificate

For those wishing only a general knowledge of chemical fundamentals, a certificate will be issued for the completion of General Chemistry 411-A and 411-B.

A certificate is also awarded for both Physical Chemistry 421 and Physical Chemistry 421-A.

ENGLISH DEPARTMENT

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Assoc. Prof. James G. Dow, A.B.
Mr. Louis W. Stearns, B.S., M.A.
Mr. Robert D. Quinn, A.M.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
English composition	511-A	X				None
English composition*	511-B				X	511-A
Appreciation of Literature	512		X			None
Vocabulary Building	515		X		X	None

Description of the Above Courses

511-A *English Composition.* The fundamentals of composition including remedial English, grammar and rhetoric.

511-B *English Composition.* A course in how to write clearly and correctly. An intensive study is made of narration, description, exposition, argumentation and the art of letter writing.

512 *Appreciation of Literature.* A course for those wishing to enlarge their cultural background and study the principles of literary appreciation and criticism. Prose and poetry will be treated analytically with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative and the philosophical.

515 *Vocabulary Building.* This course is designed to aid the student in enlarging his vocabulary and improve his understanding and choice of words. Language roots and word evolution are also considered.

Certificates

The certificate of the school will be awarded for the successful completion of 511-A and 511-B; also for 515.

* Not offered in 1951-52.

BUSINESS AND INDUSTRIAL MANAGEMENT

Staff

Prof. Charles F. Edlund, S.B., Ed.M., in charge of department
Mr. Joseph P. Conlin, A.B.
Mr. Richard W. Ivers, B.A.
Mr. Edward W. Leary
Mr. Milton Richards
Mr. Armand J. Sorbo

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Foremanship	653	X		X		None
Industrial Relations	655	X		X		None
Principles of Salesmanship	656		X		X	None
Principles of Advertising	657		X		X	None

Description of the Above Courses

653 *Foremanship.* A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

655 *Industrial Relations.* A basic course in the underlying principles of harmonious relations between employer and employee. Some of the topics covered include: company policies and the foreman, employee morale, grievances, wages, training, collective bargaining, unions, government regulations, arbitration, etc.

656 *Principles of Salesmanship.* The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

657 *Principles of Advertising.* The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

Certificates

A certificate will be awarded for the completion of any one of the above four courses.

ENGINEERING DEPARTMENT

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T.I., in charge of department
Assoc. Prof. Harry C. Brown, S.B.
Asst. Prof. Maurice E. Gelinas, S.B., A.M.
Asst. Prof. Andrew A. Ouellette, Sc.B.
Asst. Prof. Henry E. Thomas, B.T.E.
Mr. Albert L. Carpentier, B.S.
Mr. Francis L. Dacey
Mr. Robert K. Devejian, B.S.
Mr. Albert Giddis
Mr. Walter Grondalski
Mr. David K. Hines
Mr. Kenneth Hird
Mr. Ben Johnson
Mr. Carl H. Johnson
Mr. Fritz Kobayashi
Mr. Louis H. Landry
Mr. Forrest A. Mills
Mr. Arthur Peters
Mr. Clifford Strand
Mr. Chester Whitney

Mathematics and Engineering Subjects

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Mathematics	620-A	X		X		None
Mathematics	620-B		X		X	620-A
Physics	647		X		X	None
Mechanical Drawing	613-A	X		X		None
Mechanical Drawing	613-B		X		X	613-A
Mechanical Drawing	613-C		X		X	613-B
Architectural Drawing	613-D		X		X	613-A
Architectural Drawing	613-E		X		X	613-D
Blue Print Reading	638		X		X	None
Machine Shop Practice	614-A			X	X	None
Machine Shop Practice	614-B	X	X			614-A
Strength of Materials	621		X		X	None
Steam	622	X		X		None
Mechanism	630		X		X	None
Diesel Engines	632		X		X	None
Air Conditioning	634	X		X		None
Textile Testing	639	X		X		None
Quality Control in Manufacturing	646		X		X	See description
Calculus	648		X		X	Algebra and Trig.
Charts and Graphs	649	X		X		None
Textile Testing	671				X	None

Description of the Above Courses

620-A *Mathematics.* Algebra including addition, multiplication, subtraction, division, factoring and fractions.

620-B *Mathematics.* A continuation of 620-A. Some of the topics treated are grapihcal representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigonometry.

647 *Physics.* An elementary course in physics on the high school level, designed primarily for those lacking sufficient high school credits to work towards a diploma. Lecture and demonstration.

613-A *Mechanical Drawing.* The fundamentals of drawing. Use of instruments, geometric construction, lettering, orthographic projection, auxiliary views, sectional views and dimensioning.

613-B *Mechanical Drawing.* Second year for those whose interest is primarily in machine drawing. Engineering sketching, screw threads and fasteners, intersections and developments of surfaces, pictorial drawing.

613-C *Mechanical Drawing.* Third year. Sheet metal drawing, detail and assembly drawing, blueprinting from pencil and ink originals. Computation of areas, volumes and weights.

613-D *Architectural Drawing.* A continuation of 613-A for those whose main interest is in architectural drawing. The course will revolve about the design of a small house and will include a plot plan, floor plans, elevations, sections and architectural details.

613-E *Architectural Drawing.* Third year. The set of house plans begun in 613-D will be completed with drawings of heating, plumbing and electrical systems in orthographic and isometric styles. Cost estimates and a perspective of the house will complete the course.

638 *Blue Print Reading.* A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc., in order to read and understand blue prints.

614-A, 614-B *Machine Shop Practice.* A two-year course in metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, heat treatment, forging, use of special tools, etc.

621 *Strength of Materials.* A basic course in strength of materials covering such topics as tension, compression, shear, cast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, boiler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

622 *Steam.* Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

630 *Mechanism.* A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

632 *Diesel Engines.* An elementary study of diesel engines, their operation, and maintenance. Topics covered include types of diesels, fuel oils, fuel injection systems, combustion, cooling systems, application maintenance, etc. Lectures and assignments.

634 *Air Conditioning.* A course in the principles of air conditioning covering the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

639 *Textile Testing.* A study of the methods used in the determination of the physical properties of textiles and the interpretation of test data. The topics covered include a consideration of textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, tearing strength, thickness, bursting strength, crimp, twist, regain, etc. Lectures and laboratory.

646 *Quality Control in Manufacturing.* This course deals with the quality problem in manufacturing and approaches it through the use of statistical quality control. How to determine the true accuracy of a machine or process, how to distinguish between normal and abnormal variations in any process and how to use small sample plans for inspection are examples of topics covered. Prerequisite: Approval of the instructor. Normally requires two years of college or industrial experience. Statistics is not required. Limited to 25.

648 *Calculus.* The fundamental principles of differential and integral calculus. The first half covers differential calculus with the necessary analytical geometry and the second half covers integral calculus. This course is a college credit course and is accepted for credit toward the B.S. degree of Lowell Textile Institute. Only students with a good background and ability in mathematics should attempt this course.

649 *Charts and Graphs.* This course covers instruction and practice in the construction and drawing of charts, graphs, sketches, posters, etc., made with ordinary office equipment on graph paper, ditto master sheets, stencils, etc.

671 *Textile Testing.* A short course in textile testing, primarily designed for students working toward a diploma in the yarn manufacturing courses. The emphasis is on understanding and interpreting the results of the testing department or working with them rather than developing skill in the actual testing program.

Certificates

The certificate of the school is awarded for the completion of the following courses or groups of courses, described above: 620-A and 620-B; 647; 613-A, 613-B, 613-C; 613-A, 613-D, 613-E; 638; 614-A and 614-B; 621; 622; 630; 632; 634; 639; 646; 648; and 649.

ELECTRICITY

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Electrical Circuits	644	X		X		Algebra
D. C. Machinery	636-A		X		X	644
A. C. Machinery	636-B		X		X	644
Fundamentals of Electronics	640		X		X	644
Industrial Electronics	641			X	X	640
Principles of Radio	642	X		X		640

Description of the Above Courses

644 *Electrical Circuits.* A basic course in direct and alternating current circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

636-A *D.C. Machinery.* The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D. C. equipment.

636-B *A. C. Machinery.* Topics include application of instruments to A. C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

640 *The Fundamentals of Electronics.* Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

641 *Industrial Electronics.* The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

642 *Principles of Radio.* Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

Certificates

The certificate of the school will be awarded for the successful completion of any of the above six courses. Those who commenced work on the old three-year certificate prior to 1950-1951 will still be awarded three-year certificates in Electrical Machinery (644, 636-A and 636-B), Industrial Electronics (644, 640 and 641) and Radio (644, 640 and 642).

FINISHING DEPARTMENT

Staff

Assoc. Prof. Winford S. Nowell, B.M.E.
Asst. Prof. John J. McDonald, B.T.C.

		EVENINGS				
SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Woolen & Worsted Finishing	710	X		X		None
Cotton & Synthetic Finishing	711		X		X	None
Cotton Finishing Survey	718			X		None

Description of Above Courses

710 The finishing of both woolen and worsted cloths. Some of the topics covered are burling, mending, fulling, washing, speck dyeing, carbonizing, gigging, napping, steaming, brushing, shearing and pressing. Lectures and some laboratory demonstration.

711 The finishing of cotton and synthetic fabrics. Some of the topics covered are inspecting, trimming, shearing, singeing, washing, napping, mangles, starching, dryers, stretchers, callenders, folding and marking. Lectures and some laboratory demonstration.

718 A summary of the important features of Course 711, designed for diploma students in cotton yarn manufacture and others who would like a background in the finishing process.

Certificates

The certificate of the school will be awarded for the successful completion of either Course 710 or 711.

DEPARTMENT OF PAPER ENGINEERING

Staff

Prof. Geoffrey Broughton, B.Sc., M.Sc., S.M., Sc.D., in charge of department
Mr. Alfred K. Hobbs, B.S

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Paper Technology	801		X			None
Advanced Paper Technology	802				X	801

Description of the Above Courses

801 *Paper Technology.* This course covers coarse papers, fine papers, paper testing and the printing processes as applied to paper. If the class is not too large, there will be some laboratory work in paper testing. It is designed to acquaint the user or dealer in paper with the technical background of the industry.

802 *Advanced Paper Technology.* This course goes into the manufacture and use of paper in greater detail than 801. It may be taken without completing 801 providing the instructor approves.

Certificate

The certificate of the school will be awarded for the successful completion of 802.

Diploma

It is planned to offer a diploma course in paper technology in the near future. The first four years of the required six years will be in basic chemistry and will consist of General Chemistry 411-A and 411-B, Qualitative Analysis 411-C and a special one-year course in Quantitative Analysis; the fifth year will cover the principles of paper manufacture and the sixth year will be a laboratory course in paper testing and technology. Those wishing to start on the chemical portion of this diploma course now, will receive full credit towards the diploma for the above chemical courses.

DEPARTMENT OF LEATHER ENGINEERING

Staff

Prof. Albert E. Chouinard, B.S., M.S., PhD., in charge of department
Mr. Alfred H. Mueller

EVENINGS

SUBJECT and NUMBER	*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Technology of Leather 418		X		X	Chemistry

Description of the Above Course

418 *Technology of Leather.* An elementary course covering the preparation of leather of various types and finishes. The chemistry and technology of various tannery processes are covered so as to be understandable to a student with a fair knowledge of chemistry. Lectures only. 7-9 P.M.

Diploma

It is planned to offer a six-year diploma course in Leather Engineering in the near future. The first three to four years will consist of basic chemistry courses. Students interested in such a program may start with General Chemistry 411-A and 411-B and Qualitative Analysis 411-C. These courses will definitely count towards the leather diploma.

Series 55, No. 2 November, 1951

BULLETIN

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THE EFFECT OF AGITATION ON DYEING

(PART I — WOOL AND ACID DYES)*

by

J. H. Skinkle[1] and F. B. Shippee[2]

Introduction:

It has long been known that agitation in any form is advantageous to the dyeing process. Various workers, including Lemin, Vickers, and Vickerstaff (1), have found that variations in agitation during dyeing result in a variation in the amount of direct cotton dye absorbed by cotton. Nanson, Neale and Stringfellow (2), have also found this to be true on rayon as well as on cotton.

Speakman and Smith (3), in dyeing mohair and human hair with Acid Orange 2G, found a linear relationship between the dye absorbed by the fiber and the square root of the time, over long dyeing periods, in spite of the fact that the dyebath concentration decreased considerably during this time. This indicates the existence of a layer saturated with dye at the fiber surface from which diffusion into the fiber takes place. In order that diffusion of the dye into the fiber and exhaustion of the dye from the dyebath may be enhanced, it is necessary to decrease or replace this film or layer once the dye concentration in this layer has been lowered; otherwise further diffusion and exhaustion will be retarded. This is the major role which agitation plays in the dyeing process. The previous work with agitation has been performed primarily with direct cotton dyes on cellulosic material. The purpose of this work is to investigate and define the effect of agitation on wool.

Experimental:

The apparatus used for dyeing in this work required a constant, measurable source of agitation and a constant temperature bath. In order to insure not only a constant, but also a uniform agitation, a mechanical wrist-action shaker was used. This shaker was a Burrell Wrist-Action Shaker, Model CC operated by a 115 volt, 60 cycle motor. The shaker vibrated at a constant rate of 360 cycles per minute. The variations in agitation were obtained by a clutch setting on the shaker which changed the amplitude or arc through which the shaker vibrated. The clutch settings used are indicated by the amounts called "Agitation 5" and "Agitation 10." These values have no significance other than that Agitation 10 had an amplitude double that of Agitation 5. In other words, a dyeing made at setting 10 was moved through twice the distance that a dyeing made at setting 5 was moved, but at the same number of cycles per minute.

Several 300 ml Kjeldahl flasks with cork stoppers were clamped to the wrist-action shaker. These flasks were clamped so that the distance from the surface of the dyebath in the flask to the shaker arm was the same in all cases, thus insuring that each dyeing would move through the proper arc. The flasks, attached to the shaker arm, were then submerged into a water bath at $60° \pm 1°C$.

The dyeings were made on a wool serge fabric which had been previously scoured with a non-ionic detergent and thoroughly rinsed. One gram samples were dyed using a 50/1 bath ratio. The following dye formula was used for all dyeings:

1.0% Erio Floxine 2G (C.I.31)
2.0% Sulfuric Acid (96%)
15.0% Sodium Sulfate

Individual samples were dyed for lengths of time varying from 1 minute to 120 minutes. All except one set of dyeings were found to reach equilibrium exhaustion in appreciably less than 120 minutes. After dyeing, the samples were cold water rinsed and air dried. The reflectance values for all dyed fabrics were determined by measurement with a General Electric Recording Spectrophotometer.

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* Acknowledgment is made to the American Association of Textile Chemists and Colorists, copyright holders, for permission to publish this paper.

[1] Associate Professor — Lowell Textile Institute.

[2] Extracted from a thesis submitted in partial fulfillment of the requirements for the degree of Master of Science.

After each dyeing was completed, the dyebath was cooled to room temperature and its light transmission was measured with a Cenco Photelometer. Each series of dyeings was done in triplicate and the average exhaustion value was determined at each time interval.

Dyeings were made at a clutch setting of Agitation 5 and Agitation 10 as previously explained. Dyeings were also made in which a weight of glass beads equivalent to the weight of the dye solution plus the fabric was added to each dyebath, in addition to the fabric and the dye solution. This series is designated as 5G and affords a doubling of the total energy input of the dyeing process thru the use of an inert material. A series designated as 5D was made in which the total energy input was doubled by using twice the amount of dye solution and twice as much fabric. Thus a comparison may be made not only of the effect of doubling the energy by doubling the amplitude of the shaker, but also the effect of doubling the energy by doubling the force in the dyebath.

Discussion of results:

The dyebath exhaustions, shown in Table I, give the exhaustion values obtained with the various types of agitation at the indicated times of dyeing. For ease of comparison, these values have been plotted in Figure 1. This plot is made of percent exhaustion *vs.* log time in minutes. The purpose of using log time was to amplify the curve in the initial stages of dyeing as this appears to be the area where the greatest variation results through the use of different types of agitation. These curves show that agitation in any form or amount caused a marked increase in the rate of dyeing. The rate of dyeing is indicated by the slope of the exhaustion *vs.* time curve. It is obvious that, given sufficient time, Agitation 0 would also reach the 93% Exhaustion obtained by the other series. However, after seven hours, Agitation 0 was only 90% exhausted and had not yet reached equilibrium. Since times as large as, or in excess of, seven hours are not practical from a commercial viewpoint, no further investigation of this method was made. It is of interest, however, to note that even in the absence of agitation the equilibrium exhaustion seems to approach that of dyeings made with agitation, but at a much slower rate. If sufficient time could be allowed, it is possible that more level dyeings could be obtained due to this slower rate. Agitations 5 and 10 result in lines which are approximately parallel in the initial stages and thus exhibit approximately equivalent rates of dyeing. Their equilibrium exhaustion is approximately the same, 93.0% for 5 and 93.5% for 10. The principal difference in these two degrees of agitation is the amount of dye deposited instantaneously or in the first minute of dyeing. This value, often referred to as strike, is much greater with the larger amount of agitation. In the case of unlevel dyes this excessive agitation might be a distinct disadvantage.

Figure 2 shows the effect of doubling the total energy in the dyebath. The use of inert material — in this case, glass beads — has the least effect, but even this causes an increase in the dyeing rate. The effect of doubling the dye solution and the weight of fabric is to greatly increase the dyeing rate. It is interesting to note that, in all cases, increasing the energy in the dyebath has no effect upon the amount of dye deposited per unit weight of fabric in the initial dyeing period; also doubling the force does not appreciably change the equilibrium exhaustion values, although a slight increase is shown. This work on wool has shown that neither amount nor type of agitation appreciably affects the equilibrium exhaustion value. This is contrary to the results obtained by other workers on cotton and rayon.

Table II shows a comparison of the various amounts of agitation with respect to equilibrium exhaustion, time of half dyeing and time of ring disappearance. The time of half dyeing is most greatly affected by doubling the amplitude of the wrist-action shaker. Since the rate of dyeing and equilibrium exhaustion of 5 and 10 are approximately equal, this reduction in time of half dyeing is obviously due to the increase in strike, or amount of dye instantaneously deposited by setting 10. The change in the half dyeing time by doubling the force component of the energy has been found to be small but measurable.

The term "ring disappearance" means the time after which dyeing no longer takes place in a ring fashion or the time after which the concentration of dye at the center of each fiber is equal to the concentration of dye on the surface of each fiber.

The fact that dyeing, in the initial stages, takes place in a ring fashion has previously been shown by Royer (4) and others. The method by which the disappearance of this ring could be determined has been presented by Skinkle and Sumers at a northern New England A.A.T.C.C. meeting. The measurement of this characteristic is dependent upon an inter-relationship between the transmission of a dye solution and the reflectance of a corresponding dyed fabric.

It is known that dyeing is governed by two factors, the rate of deposition of dyestuff from the solution onto the fibers and the rate of diffusion of the dye particles into the individual fibers. In the initial period, while the concentration of dye on the surface is greater than the concentration of dye inside the fibers, the rate of dyeing is governed by the speed at which the dye particles diffuse into the fibers. However, after the ring disappears the rate of diffusion becomes greater than the rate of deposition and the rate of deposition becomes the controlling factor in further dyeing. In other words, in the initial period, additional particles cannot deposit until those present on the surface move to the interior and make more sites available, while in the later stages sites are always available but the concentration of dye in the solution has now been greatly decreased and deposition, by mass action, decreases also.

Table II shows that doubling the amplitude increases the length of time before the ring disappears. This indicates a decrease in the rate of diffusion of the dye into the fibers. Since the rate of diffusion is proportional to the difference in concentrations inside and on the surface of the fibers, and the concentration in the interior is initially zero, this increased agitation must have reduced the concentration of the dye on the surface of the fibers. Table II also shows, however, that the manner in which the agitation is applied to the dyebath is at least as important as the amount of the agitation. Further work on this aspect is obviously needed.

The work reported here is the first step in a continuing project on the qualitative as well as quantitative effects of agitation on dyeing rates. It is planned to continue the work with different forms of agitation, different classes of dyes, and with different fibers.

REFERENCES

(1) J. Soc. Dyers Col., 1946, *62*, 132

(2) Trans. Far. Soc., 1935, *31*, 1718

(3) J. Soc. Dyers Col. 1936, *52*, 121

(4) Am. Dyestuff Reporter, 1944, *33*, 52.

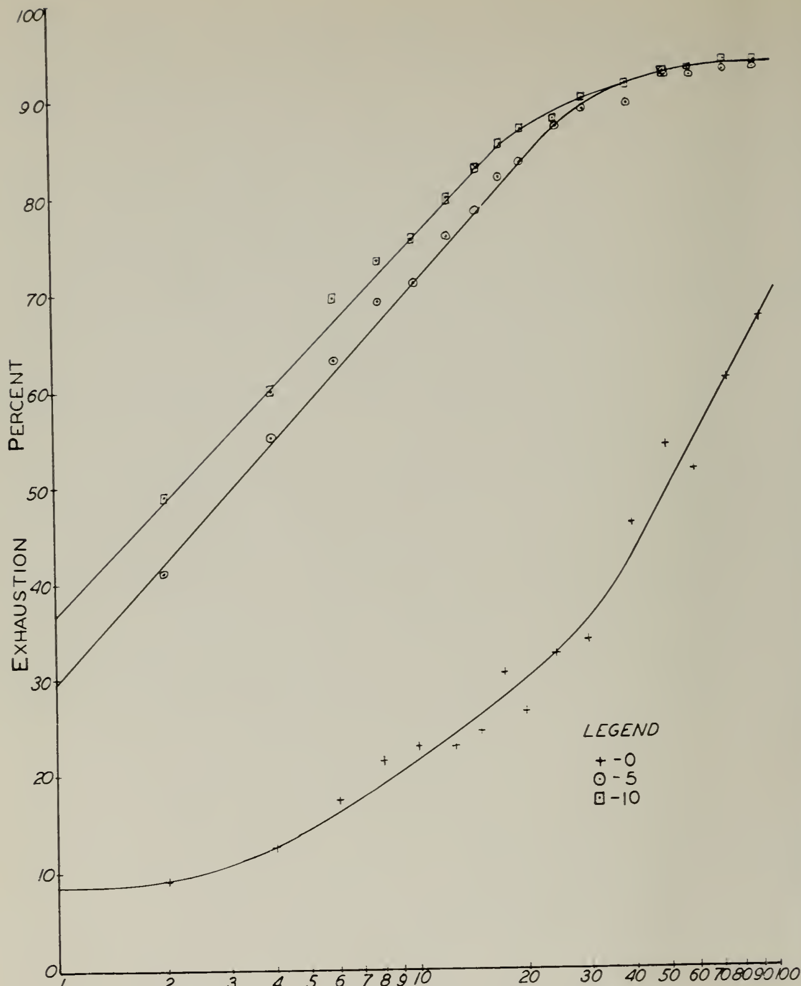

FIGURE 1 EXHAUSTION VS LOG TIME

TABLE I

t (minutes)	E_0	E_5	E_{10}	E_{5G}	E_{5D}
		(Exhaustion — Percent of Original)			
1	8.5	29.5	36.5	30.0	31.5
2	9.0	41.0	49.0	42.5	44.5
4	12.5	55.0	60.0	57.5	63.0
6	17.5	63.0	69.5	64.5	74.0
8	21.5	69.0	73.5	70.0	76.5
10	23.0	71.5	75.5	75.5	82.0
12.5	23.0	76.0	80.0	79.5	83.5
15	24.5	78.5	83.0	81.0	85.5
17.5	30.5	82.0	85.5	84.0	87.5
20	26.5	83.5	87.0	85.0	88.0
25	32.5	87.5	88.0	88.0	90.5
30	34.0	89.0	90.0	89.0	92.5
40	46.0	89.5	91.5	91.0	93.5
50	54.0	93.0	93.0	91.5	93.0
60	51.5	92.5	93.0	92.5	94.0
75	62.0	93.0	94.0	93.0	95.5
90	67.0	93.5	94.0	93.0	95.5
120	71.5	94.0	94.0	92.0	95.5
180	83.0				
300	87.0				
420	91.0				

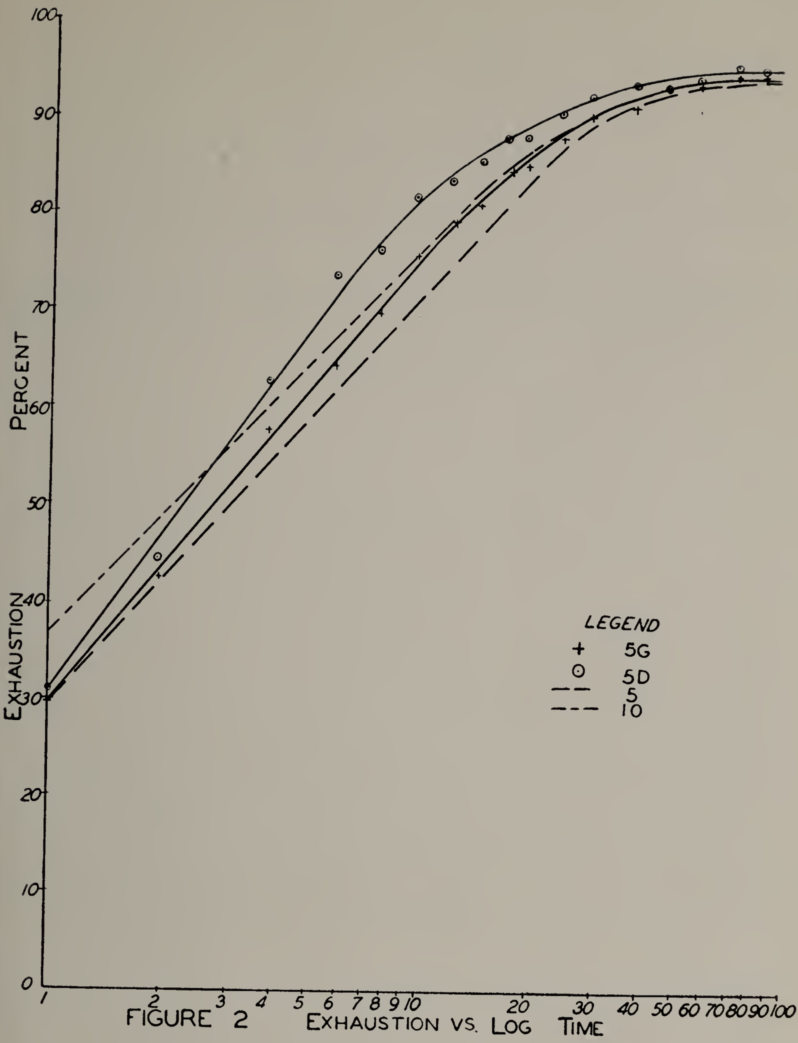

FIGURE 2 EXHAUSTION VS. LOG TIME

TABLE II

Agitation (shaker setting)	Eoo (Percent)	t½ (minutes)	Ring Disappearance (minutes)
5	93.5	2.6	12.5
5G	93.0	2.4	15.0
5D	95.0	2.2	12.5
10	93.5	1.7	20.0

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APPLYING TRACER TECHNIQUES IN THE TEXTILE INDUSTRY

by

William G. Chace*

There have appeared in the literature a number of excellent reviews of the various uses to which tracers have been put in industry and research. A few of these, relating particularly to the textile industry, are listed in the reference section of this bulletin. In view of the fact that tracers bid fair to increase our knowledge through their use in textile research, and simplify our technology through their use in our industry, it seemed worthwhile to attempt an elementary discussion of the fundamental principles on which they operate, not with the idea of making a tracer expert out of the reader, but rather in order that those whose duty it is to plan research or technical improvements may know what can be expected of this new tool of science.

In order that the operation of radioisotopic tracers may be understood, a basic knowledge of atomic structure is necessary. The discussions of atomic structure and of radioactivity which follow are presented with no claim to being in accordance with the modern, highly mathematical theories of these phenomena. They are presented in a greatly simplified form, a form which it is believed will make the later discussion of tracers more easily followed.

ATOMIC STRUCTURE

Atoms may be pictured as composed of two distinct and widely separated parts. In the center is the nucleus. This bears a positive electric charge and in it is located nearly all of the weight of the atom. Rotating around this nucleus like planets around the sun are a number of electrons. The electrons are so very much lighter than the nucleus that their weight is usually disregarded. They have a negative electric charge.

Into the nucleus are crowded two kinds of particles, protons and neutrons. The protons are positively charged and heavy. The charge which each proton carries is the unit charge of electricity. Apparently this is a fundamental charge and cannot be divided. The physicist has been unable to find a stable charge of electricity any smaller than the charge on a single proton. The number of protons in the nucleus of an element is called its atomic number.

The neutrons are uncharged particles. Each has a weight equal to that of a proton. This weight is the unit weight of the atomic weight table. The role of the neutron is apparently to act as cement for the protons in the nucleus. After all, the protons are positively charged particles, and it is well known that like charges repel each other. It would be expected that the protons, being all of like charge, would fly out of the nucleus. The neutrons serve to bind them together. However, the number of neutrons necessary to bind the protons of any nucleus is fixed. For instance, the helium nucleus contains two protons. It requires two neutrons to stabilize it. No other number will do. Some proton combinations can be bound by more than one number of neutrons, but the number of possible stable arrangements is always small.

If the number of neutrons is not correct, the resulting nucleus will be unstable. This type of instability is called radioactivity. In other words, radioactivity is the result of an unbalance of protons and neutrons in the nucleus.

Since both protons and neutrons have weight, the total weight of an atom, its atomic weight, is the sum of the weights of its protons and its neutrons. It will

* *Associate Professor of Physical Chemistry—Lowell Textile Institute.*

be recalled that the electrons are so light that their weight is negligible. All protons and all neutrons have the same weight. This is the unit weight of the atomic weight table, therefore the atomic weight is the sum of the number of protons plus the number of neutrons. It has already been stated that the number of protons is given by the atomic number. Therefore, the number of neutrons in any atom may be found by subtracting the atomic number from the atomic weight.

The electrons may be considered as rotating around the nucleus. The distance at which they rotate is relatively enormous. The diameter of the electron orbit is about 10,000 times the diameter of the nucleus. The number of electrons in a free atom is equal to the number of protons. The number of electrons varies, however, when the atom enters into chemical combination. The electrons arrange themselves in concentric shells around the nucleus. These shells and the arrangement of the electrons in them is of great importance to the chemist studying molecular structure, but not essential for an understanding of tracers.

All the *chemical* properties of an atom are determined by the electrons and their arrangement. But the number of electrons in the uncombined atom is determined by the number of protons in the nucleus, hence the most important single constituent of an atom is its protons, particularly the number of these protons. It is for this reason that atomic number is now considered more important than atomic weight; in fact, the atomic number *determines* the element. As long as we have an element whose nucleus contains 8 protons we have oxygen. The number of electrons in the exterior may be changed, and the number of neutrons may be changed, so long as the nucleus contains 8 protons, the element is still oxygen.

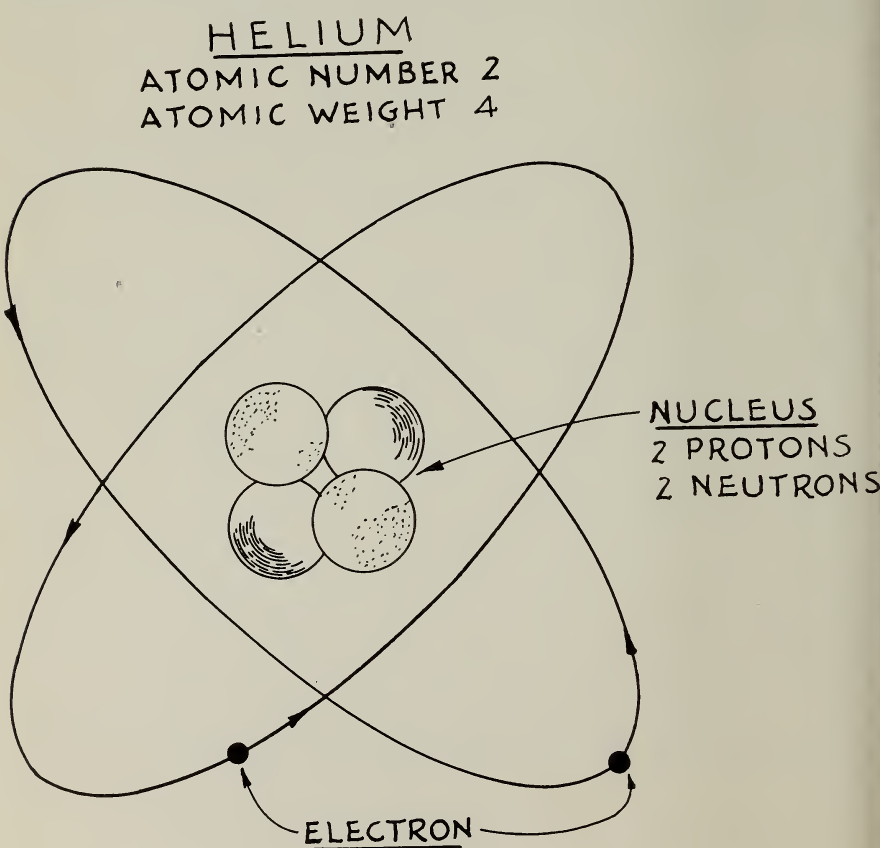

FIGURE I

A look at Figure 1 should help to clarify some of the ideas presented above. This is a representation of the helium atom. Helium has an atomic number of 2. Its nucleus therefore contains two protons, and has a charge of +2. The atomic weight of helium is 4, hence its nucleus contains, in addition to the two protons, two neutrons (4–2=2). Rotating around the nucleus at a distance are the two electrons. It is of course not possible to make the drawing to scale, but it should give some idea of what an atom might look like.

RADIOACTIVITY

The discoverers of radioactivity found that the substances which they were studying gave off "rays". When these rays were investigated, it was found that they were of three kinds. One type was heavy and positively charged. The charge was exactly twice that on a proton. These rays were called *alpha rays*. Uranium, radium, and the other naturally occurring radioactive substances give off alpha rays, but the artificial radioactive substances which are used as tracers seldom if ever emit this type of ray. It is therefore of little interest to us in our present discussion.

In addition to the alpha rays, the natural radioactive substances also produce a negative ray called *beta ray*. These rays are found to be electrons, exactly like those in the outer parts of an atom. Since beta rays are often produced by tracer elements, they are of importance to us.

The third type is given the name *gamma ray*. These rays are similar to light and X-rays. They are therefore weightless and have no charge. These also are of importance in tracer work.

For many years radioactivity was a mysterious manifestation of a few elements of high atomic weight, uranium, radium, thorium and some others. Gradually, the mystery began to be dispelled. It was found first that radioactivity was a product of the nucleus. The external electrons had no part in it. Then it was discovered that the giving off of either alpha or beta rays made a change in the nucleus and a study of that change led to the idea that radioactivity was an attempt of the nucleus to attain a stable number of protons and neutrons.

A further fact about radioactivity which was discovered early was that the amount of radioactivity decreased as time went on for any particular sample of any element. The rate of "decay," as it was called, was such that for any type of atom, the activity dropped to one-half in a given time. This time became known as the half-life. Every radioactive element has a half-life and the time of its half-life is a characteristic of the element. Uranium has a half-life of over 400 million years, radium's half-life is 1690 years, and that of radon is 3.85 days. We shall have occasion to refer to half-lives again.

Radioactivity may be pictured something like this. The nucleus of the radioactive element has an unbalance of protons and neutrons. This unbalance produces great forces within the nucleus, forces great enough to split the nucleus and throw out parts of it. When the splitting is of one type, the part thrown out consists of two protons and two neutrons, an alpha particle. Under other circumstances, the forces break up a neutron within the nucleus and throw out part of the crushed neutron, an electron. This is, of course, a beta ray. Under still other circumstances the forces produce a "settling" of parts within the nucleus and the only thing given off is energy. This energy comes out as radiation, gamma rays.

There are a few other possibilities in this process of nuclear rearrangement, the fission of the atom bomb, for example, but the above are sufficient for our purposes.

ISOTOPES

A phenomenon which was first observed during the study of radioactivity was that of isotopes.

It has been stated above that the one characteristic which determines an element is the number of protons in the nucleus. If, therefore, two atoms exist which contain the same number of protons, but different numbers of neutrons,

they will both be the same element but they will have different atomic weights. Such atoms are called *isotopes*. The word is familiar to everyone, now, since the discussion of the atomic bomb, but its real meaning is not so generally known. As an example of isotopes, ordinary chlorine is a mixture of two isotopes. Both, of course, have the same number of protons (17), one has 18 neutrons, the other 20. These two isotopes are always mixed together in chlorine and chlorine compounds. The mixture is such that although the first has an atomic weight of 35 (17+18), and the second has a weight of 37 (17+20), the mixture has an apparent weight of 35.46.

In order to indicate the exact nature of the isotope of an element, figures are placed around the symbol of the element thus

$$_{17}Cl^{35} \qquad \text{and} \qquad _{17}Cl^{37}$$

The preceding subscript indicates the atomic number (number of protons), and the following superscript gives the atomic weight. Since chlorine must have atomic number 17, it is really not necessary to write the subscript. It is usually written only when it is desired to remind the reader of the atomic number of the element indicated by the symbol. Most often the above isotopes are written

$$Cl^{35} \qquad \text{and} \qquad Cl^{37}$$

When it is desired to speak of a particular nuclear species, containing a certain number of neutrons and a certain number of protons, the term applied is nuclide. Cl^{35} is one nuclide, Cl^{37} another, both are the element chlorine.

Isotopes, since they contain the same number of protons, are the same element, and no chemical tests will distinguish between them, their chemistry is identical. (Exceptions may be noted in case of the isotopes of hydrogen, H^1, H^2, and H^3.) (Incidentally, these are the only nuclides which have names different from the symbol name of the element; H^1 is hydrogen, H^2 is called deuterium and sometimes written D^2, and H^3 is called tritium.)

ARTIFICIAL RADIOACTIVITY

All the natural radioisotopes are found among the elements of high atomic weight (over 208). The possibility of using any of these in tracer work is slight. A few early experimenters, however, did tracer work with these elements and demonstrated the extreme value of the tracer method. Extensive application of tracers was forced to wait for the development of radioactive elements of low atomic weight.

Since no low atomic weight elements which are radioactive exists naturally, it was necessary to try to produce them artificially. The first artificially produced radioactive elements were made in cyclotrons. The early cyclotron method produced very, very small amounts of the desired elements, amounts too small to be of much practical interest as tracers, but they demonstrated that it was possible to make radioelements.

It was not until the development of the nuclear pile that artificial radioisotopes were produced in quantities sufficient to be of general interest to workers in the tracer field.

An atomic pile is a device which produces a very high concentration of neutrons in a confined space. Most piles produce enough neutrons so that one million million (10^{12}) cross every square centimeter of the working space per second.

If a stable element is placed in the path of these neutrons, a small percentage of the nuclei may pick up neutrons. This will in all likelihood unbalance the nucleus so that it will become radioactive. If it does, a radioactive isotope of the element has been produced. Since only neutrons have been captured, the element is the same as before.

A typical case of this type of action is that of aluminum. Writing a neutron in the usual manner as n^1, the reaction in the pile would be

$$_{13}Al^{27} + n^1 = {}_{13}Al^{28}$$

Al^{27} is the normal aluminum, Al^{28} is radioactive. The extra neutron has made the nucleus unstable. It emits both a beta and a gamma ray, and it has a half-life of about 2½ minutes.

Many times the action in the pile is more complicated than that indicated above, but the result, an unstable nucleus, is the same.

At the present time, pile produced radioisotopes have been made for many of the elements and about one hundred different nuclides are for sale by the AEC. These may be obtained from the Atomic Energy Commission[1] at a price which covers only the handling and materials charge, since operation of the pile is charged off to bomb production. This means research and industry has available most of the common elements in radioactive form. Unfortunately, a few important ones (oxygen and nitrogen for example) have not been produced in a satisfactory form—mostly the half-lives are too short.

ENERGY AND PENETRATION OF RADIOACTIVE RAYS

Alpha, beta, and gamma rays, whether from natural or artificial radio-elements, are ejected from the nucleus with considerable energy. The amount of energy varies with the nuclide, in fact is characteristic of the nuclide.

The energies of radioactive particles are measured in a unit first developed to measure the energy of electrons in a cathode ray tube. In such a tube electrons are attracted through a vacuum from a negative plate or wire (cathode) to a positive anode. They leave the cathode source with little or no energy and arrive at the anode with an energy which depends only on the number of volts difference between cathode and anode. In these tubes energy was expressed in "electron volts" abbreviated *ev*. As tubes of higher power were produced, the energies increased, first to thousands of electron volts, *Kev* (K=1000) and then to millions of electron volts, *Mev* (M = 1,000,000). They are now building machines (Bevatrons) to give electron energies of billions of electron volts, *Bev*.

When energies of beta rays were measured, it was natural that they should be expressed in the same units, *Kev* and *Mev*, since they were moving electrons like cathode rays. Having established this as a convenient unit of energy for beta rays, it was used for all types of rays.

There must therefore be added to the characteristics already established for a radioelement, the energy of its rays.

The energy of the rays is important because it determines their penetrating power. All types of rays have the ability to penetrate matter, solids, liquids and gases. The amount of matter which a ray can penetrate is determined by its type and its energy.

Alpha rays have very little penetrating power, a few centimeters in air, a few microns in liquids and solids. Their energies range up to 7 *Mev*.

Beta rays have energies ranging from 0.015 *Mev* for H^3 to 6.5 *Mev* for I^{136}. This means a great difference in the penetrating power of different betas. It means that beta rays can penetrate from a few millimeters to a few feet of air, according to their energy, and from a few thousandths of a millimeter to a little over a centimeter of solid material. Betas have greater penetrating power per *Mev* than alphas.

Gamma rays are by far the most penetrating. Even those of low energy penetrate well, and those of highest energies will penetrate several feet of lead.

The stopping power of a substance for any of the rays is roughly proportional to its density, hence the low stopping power of air and the great stopping power of lead.

MEASUREMENTS OF RADIOACTIVITY

Most of the value of the radioisotopes as tracers stems from the methods which may be used to detect their presence and estimate their quantity.

Omitting from the discussion the alpha emitters, which it has already been pointed out are not used as tracers, three methods of detection should be considered.

The simplest method of detection and rough measurement is photographic. Both beta and gamma rays affect photographic materials readily. Furthermore, both types of ray are sufficiently penetrating so that photographic materials used for their detection can be protected from light by wrapping in black paper or light foil. The most usual photographic method used in tracer work is called *radioautographic*. The sample to be tested is placed on the photographic film and left for an appropriate time. After development, dark places will be seen on the film in places where the radioisotope was. The darker the film the greater was the concentration of "hot" material in that spot. The method has been used to study the movement of juices in living plants and in studying diffusion in solids. Radioautographs are very simple in the equipment needed and in technique, but their use is limited to those cases where the sample and the film can be placed in juxtaposition and kept stationary for long enough to get the exposure. It is probably the least used method in industrial and physical use of tracers.

The method most used in tracer work is the Geiger-Muller counter[2]. This is an electrical method. Space does not allow of a description of the action of a Geiger counter, but it may be said that any time a beta or a gamma ray enters the Geiger tube an electrical impulse is created by the tube. This impulse is then amplified and made to operate a combination electronic and mechanical counter. The equipment can be made either quite compact for portability and convenience, at some sacrifice of accuracy, or it can be made larger, more intricate and more expensive with great increase in accuracy. Theoretically, a Geiger counter will register every particle which enters the tube. This would mean that it could detect a single radioactive occurrence. Actually, there are a few limiting factors which prevent it from catching every ray, but it is fully adequate for the job of detecting tracers.

In practice the Geiger tube is placed near the sample and the rays counted as they enter. Since betas and gammas are penetrating, all that is necessary is for the tube to be near the sample. Of course, the weaker the radiation from the tracer in the sample, the nearer the Geiger tube must be, and the thinner its walls must be also.

The third method of detecting rays depends on their ability to make air a conductor of electricity. This process, known as ionization, occurs when either of the rays under consideration passes through air. A device known as an ionization chamber[3] is charged with electricity. If no rays enter such a chamber, the charge of electricity remains unchanged. If, however, rays are allowed to enter, they ionize the air, it becomes a conductor of electricity and the charge leaks off through the conducting air. Some electronic device measures the change in charge. The advantage of this method is that it can be made to measure the total number of particles passing into the chamber over a relatively long time. It can also be made very small. One such device is made the size of a fountain-pen and is worn in he pocket of workers in tracer laboratories in order to determine whether they have been subjected to radiation. At the end of a period of work with tracers, the charge on the pocket meter is read and the worker knows whether he is nearing the limit of exposure which he may safely take.

Ionization chambers are also used for experiments where large volumes of gas of low activity must be examined.

TRACERS

Examination of the properties of the radioisotopes, as discussed above, will show the reason why they serve as tracers.

A tracer is a substance which cannot be distinguished, by the system in which it is placed, from other similar substances, but may be so distinguished by the experimenter.

Tracers, being isotopes of common elements, have exactly the same chemical and physical properties as the non-radioactive isotopes of these elements. They

can therefore be mixed with these usual isotopes or substituted for them and any chemical or physical action will proceed without change.

Their radioactivity makes it possible for their presence and amount to be detected from a distance without stopping or in any way disturbing the reaction. Any other method of investigating the reaction would necessitate some disturbance, even inserting electrodes may upset a reaction.

This means that the amount of any constituent may be determined continuously in a varying process without stopping the process. The constituent to be followed is made radioactive, added as a tracer and the product made to pass under a Geiger tube. As an example, it might be desired to investigate the effect on the removal of suint, of adding a particular scouring agent to the wool scouring train. A wool sample could be prepared containing some radio-potassium to label the suint. If now the wool is run through the train and a Geiger tube is placed so that the product feeds past it, the amount of suint, as indicated by the tagged potassium will be indicated continuously. As the conditions in the train are changed, the result of the change on the amount of suint is indicated.

Or, conversely, any constituent may be followed through a process, observing how it divides between two alternate paths, etc.

Tracers have been employed in a research of this type in studying the movement of fibers in a blend, during yarn production. By making one yarn of the blend radioactive, it was possible to follow that particular part of the blend in each step of the yarn manufacture. An answer was found to the problem of why yarn blends frequently do not have the same percentage as the fibers put in at the beginning.

Another use of tracers comes from their action as tagged atoms. When mixed with other atoms of the same element, these atoms behave the same chemically, but they may always be distinguished from other atoms by their radioactivity. This has been a very fruitful method of using tracer elements. It allows the determination of the source of atoms in a particular product or molecule.

Still another use of tracers comes from the very small amounts which may be detected. The sensitivity of detection methods, of course, varies for different substances in both chemical and radioactive methods, but it is estimated that the radioactive method can detect substances in concentrations one thousand to ten thousand times less than the chemical method.

An indirect use of these elements, the use of their penetrating rays, to detect the presence of some object, while not a tracer use, nevertheless, makes use of some of the same properties and may well be discussed here. Many times it is necessary to know the exact location of some object inside a piece of opaque apparatus. By making that object radioactive with gamma rays, its position may readily be determined with a counter placed outside the apparatus. Use has been made of this technique in a device for determining the viscosity of viscose solutions with a falling ball viscometer. By making the ball of steel containing a small amount of radioactive cobalt (Co^{60}) which gives off gamma rays, the time when it passes the marked points may be determined without trying to see through the thick viscose solution.

Thickness of a material may be determined by interposing it between a radioactive source and a detector. The absorption of the rays by the material indicates its thickness without touching it, a great advantage when soft materials like textiles are being gaged.

These are some of the types of uses to which radioisotopes have been put. The technique is young, other uses will doubtless be found when more general use is made of these elements.

Here is a review of what radioactive tracers offer:

1. Radioelement is identical chemically with ordinary element.
2. May be detected and estimated from a distance.
3. May be detected and estimated without in any way disturbing the action being investigated.
4. May be detected at very low concentrations.
5. Act as tagged elements, capable of being identified among samples of that element from other sources.

6. Act as sources of radioactivity suitable for detecting presence of objects.
7. May serve to measure thickness or area of objects without touching these objects.

A reading of some of the reviews of uses listed in the reference section will give an idea of how these properties have been made use of.

CHOICE OF TRACER

When it has been decided that tracer technique is to be used in a certain problem, a number of questions must be answered.

First, the proper tracer elements must be chosen. Unless the substance to be tagged is an element, any element in the compound or group under investigation may be tagged. The decision of which element to tag will depend on availability, type of rays emitted, energy of the ray, half-life, price, and synthetic procedures required to prepare the required compound.

A study of the catalog of the Atomic Energy Commission[1] will settle the question of what radioisotopes of the possible elements are available. This will probably narrow the choice down considerably. Some elements just are not available as useful radioisotopes (oxygen, nitrogen, silicon). Having decided what elements are available, the choice can be further narrowed by noting the rays emitted by the elements still under consideration. Not only the rays but the energy should be noted at this stage. Assuming that the indicating equipment is a Geiger counter and that it is so arranged that either end window or glass tubes may be used a little preliminary thought about the method of counting should be undertaken at this point. Intelligent choice cannot be made until the method of counting has been settled.

Geiger tubes are available in two main types, end window and glass. In the end window type, the rays enter through the end of the tube and this end is closed by a thin window of mica. Since mica can be made much thinner than glass, this type is best to use when rays of low energy must be used. The end window type is best for counting solids and in cases where the position of the radioactivity must be determined.

Since the mica window cannot be put in a liquid, it is not the best for counting liquids, especially if the volume is large. Glass tubes are less fragile and less expensive than end window tubes. Their great disadvantage is the fact that they must be made of such thick glass that a rather high energy ray must be used.

Having decided on the method of counting, it is possible to make a decision between the isotopes available. One must be chosen with energy appropriate to the counting method to be used. In general, between beta and gamma rays of equal suitability, it is better to choose the beta because it is so much easier to shield beta rays and protect the operator. It may turn out here that there are no isotopes with energies high enough for glass tube counting. In that case, a review of the counting technique will need to be made, end window tubes must be used.

Another item to be considered while a study is being made of the catalog is the half-life. Obviously it is useless to chose an isotope which has a half-life of a few minutes. Several days should be considered the minimum, but in a few cases (Na^{24}) it may be necessary to choose an isotope of shorter half-life and plan accordingly.

At first glance it would seem as if the choice should always be the element with the longest half-life. However, choosing an element with a long half-life introduces the waste disposal problem. Radioisotopes cannot be disposed of by throwing their solutions down the drain. This would contaminate the sewage system and endanger the public. Consequently, all products of the experiment must be kept under supervision until they have decayed to practical nonactivity. The time for this is usually given as ten half-lives. It can now be seen why elements of intermediate half-lives are desirable. Half-lives of a few weeks to a few

months give enough time for the experiments and come to their ten half-life time in reasonable period.

In industrial testing, short half-life is even more desirable. It means that the product used in the test need not be considered as expended. By choosing an isotope of short (few days) half-life, the material used in the test may be put aside for ten to twenty half-life periods under supervision and then, after thorough monitoring, put back into process.

It may now be assumed that a choice has been made of the best isotope on the bases noted above. Another problem arises. Will it be possible to synthesize the molecule that is needed for the experimental work. Several laboratories have been synthesizing radiomolecules for sale, but most of their products are suitable for biological research. There is great possibility, therefore, that the worker will have to synthesize his own material. Since the synthetic work will be done at a higher level of activity than the experiment itself, a method of synthsis must be worked out in which the radioisotope is handled as little as possible. Probably more thought and ingenuity will be required here than in designing the primary experiment.

SUMMARY

An attempt has been made to give a brief background of theory in order that the radioactive tracers may be understood. Atomic structure is briefly reviewed. An elementary treatment of radioactivity is presented.

Tracers and tagged elements are defined and the types of uses to which they have been put are listed. A discussion of the problems incident to the choice of a tracer for a problem is included.

It is the hope of the author that the brief discussion given will point out to workers in the textile industry the possibilities of tracers. With a knowledge of their possibilities and limitation, there is no doubt that radioactive tracers may be used to solve many of the knotty problems of the textile industry.

A tracer laboratory has been installed at the Lowell Textile Institute. It will be used for industrial as well as fundamental research. It is open for inspection by any who may be interested in the type of equipment required.

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The Institute reserves the right to make changes in the regulations, courses, and charges announced in this Bulletin.

INSTITUTE CALENDAR

FOR

1952

September 10, Wednesday, 8:30 A.M.	First semester begins for freshmen.
September 11, Thursday, 8:30 A.M.	Registration for *all* other students. *Late registration fee applies after this date.*
September 15, Monday, 8:30 A.M.	All classes begin.
September 16, Tuesday, 3:30 P.M.	President's Convocation.
September 26, Friday	Last day to register for new classes.
October 13, Monday	Columbus Day celebration. Institute closed.
October 14, Tuesday	Last day to drop classes without penalty.
November 11, Tuesday	Armistice Day. Institute closed.
November 26, Wednesday, 11:20 A.M. to December 1, Monday, 8:30 A.M.	Thanksgiving recess.
December 20, Saturday, 12:20 P.M. to January 5, Monday, 8:30 A.M.	Christmas recess.

1953

January 5, Monday, 8:30 A.M.	Classes resume.
January 19, Monday, 8:30 A.M.	
January 28, Wednesday, 4:20 P.M.	First semester examinations.
January 29, Thursday, 8:30 A.M.	Registration for the second semester. *Late registration fee applies after this date.*
February 2, Monday, 8:30 A.M.	All classes begin.
February 3, Tuesday, 3:30 P.M.	President's Convocation.
February 13, Friday	Last day to register for new classes.
February 23, Monday	Washington's Birthday celebration. Institute closed.
March 2, Monday	Last day to drop classes without penalty.
March 28, Saturday, 12:30 P.M. to April 8, Wednesday, 8:30 A.M.	Easter recess.
April 20, Monday	Patriot's Day celebration. Institute closed.
May 25, Monday, 8:30 A.M. to June 3, Wednesday, 4:30 P.M.	Second semester examinations.
May 30, Saturday	Memorial Day. Institute closed.
June 8, Monday	Commencement Exercises.
September 9, Wednesday, 8:30 A.M.	First semester begins for freshmen.
September 10, Thursday, 8:30 A.M.	Registration for *all* other students.
September 14, Monday	All classes begin.

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John J. McDonald, B.T.C. (Lowell Textile Institute), 12R Third Ave,. Lowell.

Winford S. Nowell, B.M.E. (Northeastern University), 8 Fulton St., Methuen.

Allen Scattergood, A.B. (Columbia University), Ph.D. (Princeton University), 475 Beacon St., Boston.

Assistant Professors

Charles L. Daley, B.T.C. (Lowell Textile Institute), 465 Pine St., Lowell.

Charles A. Everett, B.T.C. (Lowell Textile Institute), 12 Warren Ave., Chelmsford.

Charles L. Howarth, B.T.C. (Lowell Textile Institute), Pollard St., North Billerica.

Walter J. Lisien, B.T.C. (Lowell Textile Institute), 589 School St., Lowell.

Joseph B. Masaschi, B.T.C., M.S. (Lowell Textile Institute), 3 Hill Top Terrace, Chelmsford.

Instructors

Herman Brown, B.S. (Northeastern University), 9 Grace St., Lowell.

Roland E. Derby, Jr., S.B. (Massachusetts Institute of Technology), R.F.D. No. 2, Varnum Ave., Lowell.

Vasilis Lavrakas, B.S. (University of Massachusetts), M.S. (Tufts College), 141 Parkview Ave., Lowell.

Ray E. MacAusland, 528 Westford St., Lowell.

Robert J. Peirent, B.S. (Lowell Textile Institute), 663 Hildreth St., Dracut.

Secretary

Mona P. MacKenzie, 1424 Bridge St., Dracut.

DEPARTMENT OF COTTON YARNS AND KNITTING

Professor and Head of Department

Gilbert R. Merrill, B.T.E. (Lowell Textile Institute), 364 Varnum Ave., Lowell.

Associate Professor

Nathaniel E. Jones, Diploma in Cotton Manufacture (Lowell Textile Institute), 229 Dracut St., Lowell.

Assistant Professors

John A. Goodwin, B.T.E., MS. (Lowell Textile Institute), 105 Chestnut St., Lowell.

Clarence J. Pope, B.S. (Clemson College), M.S. (Lowell Textile Institute), 40 Beacon St., West Andover.

Instructor

Ferrell G. Kent, Diploma in Cotton Manufacture (Lowell Textile Institute), 27 Nahant St., Wakefield.

DEPARTMENT OF DESIGN AND WEAVING

Professor and Head of Department

Vittoria Rosatto, B.S. (Massachusetts School of Art), 63 Bradstreet Ave., Lowell.

Professor Emeritus

Hermann H. Bachmann, 146 Parkview Ave., Lowell.

Associate Professors

Russell M. Fox, Certificate in Cotton Design (Lowell Evening Textile School), 359 Beacon St., Lowell.

Edward L. Golec, Diploma in Textile Design (Lowell Textile Institute), 32 Elsmere Terrace, Dracut.

John L. Merrill, B.T.E. (Lowell Textile Institute), 2026 Middlesex St., Lowell.

Assistant Professors

George G. Armstrong, Jr., 26 Adams St., Littleton.

Martin J. Hoellrich, Certificate in Weaving (Lowell Evening Textile School), 30 Saxonia Ave., Lawrence.

Instructors

Robert C. Gray, 108 High St., North Andover.

Albert T. Woidzik, B.S. (Lowell Textile Institute), 59 Crescent St., Lowell.

DEPARTMENT OF LANGUAGES AND HUMANITIES

Professor and Head of Department

Lester H. Cushing, A.B., Ed.M. (Harvard University), 25 Nicollet St., Lowell.

Associate Professor

James G. Dow, A.B. (Boston University), 18 Burtt St., Lowell.

Assistant Professors

Wallace C. Butterfield, B.S. (University of Pennsylvania), 13 Sylvan Ave., Chelmsford.

James C. Riley, A.B. (St. Anselm's College), 4 Hanks St., Lowell.

Louis W. Stearns, B.S. (Tufts College), M.A. (Harvard University), 20 Steadman St., Chelmsford.

Instructors

David B. Morley, B.S. (Dartmouth College), M.A. (New York University), Eames Hall, Lowell Textile Institute, Lowell.

Waldo W. Yarnall, B.S. (University of Vermont), Nabnasset Rd., Westford.

DEPARTMENT OF LEATHER ENGINEERING

Professor and Head of Department

Albert E. Chouinard, B.S., M.S. (Holy Cross College), Ph.D. (Clark University), Lakeview Ave., Tyngsboro.

DEPARTMENT OF PAPER ENGINEERING

Professor and Head of Department

John Lewis, B.S., M.S. (University of Maine).

Visiting Professor

Horace N. Lee, B.S. (University of Maine), A.M. (Harvard University), 41 North Ave., Melrose.

Instructor

Alfred K. Hobbs, B.S. (University of Maine), M.S. (Lowell Textile Institute), 187 Textile Ave., Lowell.

DEPARTMENT OF PHYSICAL EDUCATION

Director of Athletics

Lester H. Cushing, A.B., Ed.M. (Harvard University), 25 Nicollet St., Lowell.

Instructors and Coaches

David B. Morey, B.S. (Dartmouth College), M.A. (New York University), Eames Hall, Lowell Textile Institute, Lowell.

Waldo W. Yarnall, B.S. (University of Vermont), Nabnasset Rd., Westford.

DEPARTMENT OF SOCIAL SCIENCES

Professor and Head of Department

Charles F. Edlund, S.B. (Massachusetts Institute of Technology), Ed.M. (Harvard University), 68 Baldwin St., Lowell.

Professor

John R. Robertson, A.B. (Bowdoin College), A.M. (Harvard University), Topsfield.

Assistant Professor

Stuart L. Mandell, A.B. (Brooklyn College), M.B.A. (Syracuse University), 52 Columbus Ave., Haverhill.

DEPARTMENT OF SYNTHETIC TEXTILES

Professor and Head of Department

CHAPIN A. HARRIS, B.S. (University of Michigan), Ph.D. (Massachusetts Institute of Technology), 20 Balfour St., Lexington.

Associate Professor

JACOB K. FREDERICK, JR., B.S. (Rhode Island School of Design), 447 Princeton Boulevard, Lowell.

Instructor

DAVID H. PFISTER, B.S., M.S. (Lowell Textile Institute), 120 Fulton St., Lowell.

DEPARTMENT OF TEXTILE ENGINEERING

Professor and Head of Department

HERBERT J. BALL, S.B. (Massachusetts Institute of Technology), B.C.S. (Northeastern University), Fellow of the Textile Institute (British), 34 Pentucket Ave., Lowell.

Professor

A. EDWIN WELLS, B.T.E. (Lowell Textile Institute), M.Ed. (Boston University), 37 Ashland St., Melrose Highlands.

Visiting Professor

WALTER J. HAMBURGER, S.B., S.M. (Massachusetts Institute of Technology), Ph.D. (Polytechnic Institute, Brooklyn), 62 Abbott Rd., Dedham.

Associate Professors

HARRY C. BROWN, B.S. (Brown University), 272 Merrimack St., Lowell.

MAURICE E. GELINAS, S.B. (Massachusetts Institute of Technology), A.M. (Harvard University), 283 Textile Ave., Lowell.

MILTON HINDLE, B.T.E. (Lowell Textile Institute), 25 Thurston Rd., Melrose Highlands.

HENRY E. THOMAS, B.T.E. (Lowell Textile Institute), 192 Parker St., Lowell.

Assistant Professors

J. ARTHUR AINSWORTH, B.S., M.S. (Fitchburg Teachers College), 69 Amherst St., Nashua, N. H.

JAMES W. BELL, Diploma in Electrical Engineering (Benson Polytechnic Institute), Box 343, Court St., Groton.

HORTON BROWN, B.S. (Tufts College), 178 Atlantic Ave., Marblehead.

*ISAAC CHASE, JR., B.S. (Rhode Island State College), 52 Gay St., North Chelmsford.

ADOLPH KATZ, B.S. (Northeastern University), M.S. (Harvard University), 34 Edgewood St., Roxbury.

*~~ROBERT M. KENNEDY,~~ B.T.E. (Lowell Textile Institute), Fiske St., North Tewksbury.

ANDREW A. OUELLETTE, B.S. (Brown University), 44 Taylor St., Nashua, N. H.

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*On military leave.

Instructors

Robert K. Devejian, B.S. (Tufts College), 9 Arch Ave., Haverhill.

Philip A. Hall, B.S. (University of New Hampshire), 26 School St., West Chelmsford.

Elliot F. Humiston, Jr., S.B. (Massachusetts Institute of Technology), 12 Guild St., Lowell.

*Ernest W. Lareau, B.S. (Duke University).

Kenneth L. Rogers, B.S. (University of Maine), 3 John St., Methuen.

Edward N. Sabbagh, S.B. (Massachusetts Institute of Technology), 107 Chestnut St., Andover.

Secretary

Dorothy A. Michael, 92 Hastings St., Lowell.

DEPARTMENT OF WOOLEN AND WORSTED YARNS

Professor and Head of Department

James H. Kennedy, Jr., B.T.E., M.S. (Lowell Textile Institute), 43 Sylvan Ave., Chelmsford.

Assistant Professors

J. Frederic Burtt, B.T.E. (Lowell Textile Institute), 97 Hoyt Ave., Lowell.

Michael J. Koroskys, B.S. (Lowell Textile Institute), 1 Thorndike St., Lawrence.

Instructor

Russell L. Brown, B.S. (Lowell Textile Institute), 57 Burtt St., Lowell.

DEPARTMENT OF AIR SCIENCE AND TACTICS

Professor and Head of Department

Lt. Col. Walter E. Kelly, B.S. (Villanova College), 67 High St., Chelmsford.

Assistant Professors

Capt. Frederic D. Ingersoll, 77 Turnpike Rd., Chelmsford.

Capt. Richard L. Mesle, B.A. (University of California at Berkeley), Chamberlain Corner, Westford.

Instructors

M/Sgt. Paul E. Blais, 226 Mitchell St., Manchester, N. H.

M/Sgt. Arthur C. Hawkins, 24 North Rd., Chelmsford.

M/Sgt. Michael J. Taylor, B.A. (University of California at Los Angeles), 26 Hampson St., Dracut.

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*On military leave.

ALUMNI ASSOCIATION

The membership of the Alumni Association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has satisfactorily completed at least one year of the day curriculum. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

OFFICERS AND DIRECTORS FOR THE YEAR 1952-1953

Philip E. MacLean, '47, *President*

Kenneth B. Cook, '13, *First Vice-President*

A. Edwin Wells, '20, *Executive Secretary, Clerk and Treasurer*

Ernest P. James, '42, *Assistant Secretary*

ALUMNI FUND COUNCIL

Evan H. Fairbanks, '35, *Chairman*

Philip E. MacLean, '47, *Chairman, Fund Committee*

BOARD OF DIRECTORS

Term Ending 1953

Philip E. MacLean, '47

James A. Irvine, '17

Gerald F. Quigley, '31

Robert C. Wilkie, '34

Milton Hindle, '25

Term Ending 1954

Harold W. Leitch, '14

Charles H. Forsaith, '20

Kenneth B. Cook, '13

William T. Dewey, '34

Raymond W. McKittrick, '28

Term Ending 1955

G. Harry Gwinnel, '25

David A. Travis, '24

Levon M. Yacubian, '26

Philip E. Mason, '26

Robert M. Bent, Jr., '46

Advisories

Martin J. Lydon, *President, Lowell Textile Institute*

Samuel Pinanski, '12, *Chairman, Trustees, Lowell Textile Institute*

Ralph K. Hubbard, '11, *Past President, Lowell Textile Institute Alumni Association*

LOWELL TEXTILE INSTITUTE

The Lowell Textile Institute, formerly known as the Lowell Textile School, was incorporated under the laws of Massachusetts in 1895 and functioned as a private institution and a recipient of state aid for several years following its inception. Its formal opening took place on January 30, 1897 with a teaching staff of thirteen and a student body of thirty-three. The school occupied rented quarters in downtown Lowell until the completion of Southwick Hall, the first of its present buildings, in January, 1903. The property of the school was transferred to the Commonwealth of Massachusetts in July, 1918 and since that time control and management have been vested in a Board of Trustees appointed by the Governor.

The name of the school was changed to Lowell Textile Institute in 1928 in order to indicate more clearly the standing of the institution.

In December, 1948, the Institute was accepted to full membership in the Senior College Division of the New England Association of Colleges and Secondary Schools. The United States Department of Education and the Armed Forces consider such membership equivalent to regional accreditation. The Engineers' Council for Professional Development extends full accreditation to the curricula in Textile Engineering.

According to the original act authorizing its establishment, the Institute was founded "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry". Throughout the years it has steadily broadened its scope both in physical equipment and educational service, keeping pace with the progress of the industry it serves. In a continuing effort to render the greatest possible educational opportunities to the Commonwealth, the program of the Institute was broadened, in September, 1950, to include curricula in Paper Engineering and Leather Engineering.

During the early years of the Institute's existence, in keeping with its initial educational objectives, no degrees were offered but diplomas were given for the completion of specified courses of study. However, in 1913, the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C) were conferred on those students who completed four years' study in one of the several curricula offered at the Institute. All vocational work is offered in the Lowell Evening Textile School program which is described in another bulletin.

Lowell Textile Institute now confers the degree of Bachelor of Science upon successful completion of the requirements of one of the several curricula listed on pages 00-00 of this catalogue. It also confers the Master of Science degree for successful completion of graduate studies in Textile Chemistry, Textile Engineering, Paper Engineering, and Leather Engineering, and has limited offerings in Textile Manufacturing and Synthetic Textiles.

The curricula of the Institute are under constant study. Revisions are made whenever it is clearly indicated that changes are necessary in order for the Institute to fulfill its traditional purpose of service to the industries. In choosing the present curricula, the Administration and Faculty have been aware of their obligation to prepare students for entrance into the industry of their choice whether it be the Textile, Paper, Leather, or similar fields. In addition to fundamental courses in the physical sciences and engineering, considerable work in practical industrial applications has been included. Broadening yet practical courses in English and the social sciences have been woven into all curricula in a conscious effort to produce graduates who are not only well trained technically but are prepared to take their places in society. It has been recognized in the preparation of these curricula that no college program can adequately produce a specialist. The aim is to provide the student with a solid fundamental background and to predispose him to obtain additional and specialized education after graduation.

COEDUCATIONAL

Within the last few years, the possibilities for women in certain branches of the textile field have become recognized, and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, since it offers a broad training that prepares for many lines of activity. For those who wish to specialize in structural and decorative textile designing, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

LOCATION

Lowell Textile Institute is located in Lowell, a city of 100,000, long famous as a great center of the textile industry. The campus occupies a commanding site on the west bank of the Merrimack River, overlooking the rapids of Pawtucket Falls, which furnished the first extensive use of water power in America for the operation of power looms. The 15 acres which constitute the main campus were given by Frederick Fanning Ayer, Esquire, and the Proprietors of the Locks and Canals on the Merrimack River.

BUILDINGS

Southwick Hall—The offices of the President, Dean of the Faculty, Dean of Students, Registrar, Admissions, the Business Officer, and the Department of Engineering, are located in the north wing; the Department of Chemistry, Dyeing and Finishing, in the south wing. The central section, which houses the gymnasium and the Assembly Hall, is pierced by an archway which gives access to the central courtyard. Erected in 1902 by contributions of the Commonwealth of Massachusetts and Mr. Frederick Fanning Ayer as a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days and a maternal ancestor of Mr. Ayer.

Kitson Hall—The Department of Cotton Yarns and Knitting, the Mechanical and Electrical Engineering laboratories, and the Machine Laboratory. Erected in 1902 as a memorial to Richard Kitson, founder of the Kitson Machine Company of Lowell and a leading manufacturer of the city, by gifts from Charlotte P. Kitson and Emma K. Stott, his daughters, and the Kitson Machine Company.

Falmouth Street Building—Departments of Design and Power Weaving, Woolen and Worsted Yarn, Synthetic Textiles, and the picker section of the Cotton Yarn Department. Erected in 1903 as a one-story building, and finally enlarged to its present capacity in 1907 by the Commonwealth of Massachusetts.

Louis Pasteur Hall—Offices of the Wool Department, Cotton Finishing Laboratory, research laboratories in Chemistry, Textile Coloring, and Finishing, laboratories, classrooms, and lecture rooms. Originally constructed as a one-story building, it was subsequently enlarged to three stories, in 1937, by the Commonwealth of Massachusetts.

Paper and Leather Building—Departments of Paper Engineering and Leather Engineering, with extensive floor space allotted to the Physics Section. Completed in 1952, through funds appropriated by the Commonwealth of Massachusetts.

Alumni Memorial Library—This building has become a reality as a result of contributions by the Alumni and many members of the Textile Industry. This modern building was dedicated in 1951 in honor of Lowell Textile men and women who served in the first and second World Wars and the Korean conflict. In area the building is 120 feet by 65 feet and is of Georgian Colonial

design. It has a book stack capacity of 80,000 volumes and its reading rooms seat 150 students. The first floor contains three reading rooms, private study areas, a typing room, the librarian's office, a book preparation room, and book stacks extending above the second floor level. The second floor contains a mezzanine reading room, a microfilm and microcard room, alumni offices, faculty lounge and studies, and an exhibition room. The ground floor contains complete office facilities for under-graduate student activities, a mail room, private study areas, and a library activities office, as well as additional stack space.

The library shelves hold some 10,000 volumes in a wide variety of subjects, with special emphasis on textiles, chemistry, and engineering. The Edgar Francis Billings Literature Collection contains a number of the world's best known classics. All of the scientific journals in textile and allied fields are available, as well as journals of general interest.

The library is also a depository library for U. S. Government Publications, with approximately 3,000 items being added to this collection each year.

Smith Hall—Men's residence hall with accommodations for 112 students and a faculty proctor, a dispensary for students, and quarters for the resident nurse. The college cafeteria, in the basement, caters to all students and the faculty. Smith Hall is dedicated in honor of James T. Smith, pioneer educator in the textile field, the individual primarily responsible for the organization of Lowell Textile Institute. Erected in 1948 by the Lowell Textile Institute Building Association.

Eames Hall—Men's residence hall with accommodations for 112 students, plus an apartment for a married faculty proctor. Also has a Student Lounge and Snack Bar, fully equipped for lounging and recreation. It is dedicated in honor of Charles H. Eames, President of the Institute, 1905-1945. Erected in 1949 by the Lowell Textile Institute Building Association.

Power Plant—Back of great quadrangle.

Athletic Field—northeast of main campus. First used for baseball in 1938, this area is being further improved to provide a modern athletic center for baseball and other sports. AF-ROTC also uses this area as a drill field.

EQUIPMENT

Now housed in the various buildings of the quadrangle is an extremely varied set of textile machinery covering all of the basic systems for handling staple and continuous filament fibers, from raw material to finished products, including special types of looms, and lace-making machinery. The Paper and Leather Building will house the machinery essential to instruction in all phases of the manufacture, control, and testing of all grades of paper and leather. All machines and equipment will, as now, be closely integrated with modern laboratories in physics, chemistry, and engineering, and in chemical, physical, and optical testing. All laboratories, including those with machines which are exact replicas of commercial models, are geared to both teaching and research.

RESEARCH FOUNDATION

In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract with responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

In order to facilitate the research work of the Institute, the Massachusetts State Legislature, in November 1950, authorized the establishment of the Lowell Textile Institute Research Foundation.

GENERAL VIEW OF SMITH HALL AND MAIN BUILDINGS

SOUTHWICK HALL

This Research Foundation provides the necessary mechanism whereby all of the research work of the Institute is brought under one coordinating office headed by the Executive Director. As in the past, however, the faculty of the Institute does the greater part of the research work. This plan has been proven through years of experience to be very beneficial to both the Institute and the client.

The Foundation has the use of the Institute's laboratory and research facilities. This arrangement places at its disposal the regular laboratories in chemistry, physics, and engineering; the completely equipped laboratories in all phases of textile, paper or leather processing; the laboratories for textile dyeing and finishing; and the testing laboratories for textiles, paper, and leather. In addition, the Institute has many unusual research facilities. These include a completely equipped laboratory for work with radio-active materials, an Instron tester, x-ray diffraction equipment, a large spectrograph, recording spectrophotometers, a pulse-propagation meter, a completely equipped laboratory for microscopic work including a phase microscope and an electron microscope.

GENERAL INFORMATION

ADMISSIONS

New students at the Lowell Textile Institute are selected by a group of faculty members functioning as the Committee on Admissions. The Committee endeavors to accept for membership in the freshman class those applicants who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership. In addition to test results, scholarly attainments, and other traditional standards of measurement, the Committee sets a high value on the personality characteristics of each individual candidate, together with his extracurricular interests and contributions to school and community life.

PROCEDURE

Formal application for admission should be made as early as possible in the candidate's senior year of secondary school. (Students from foreign countries are strongly advised to begin admission procedures not less than twelve months in advance of the expected date of enrollment.) Requests for application blanks and all correspondence relating to matriculation at the Institute should be addressed to the Director of Admissions. Preliminary correspondence before the senior year is welcomed, and encouragement is extended to every effort which will tend to harmonize the prospective student's interests and activities with his freshman year at the Institute.

Steps to be taken for admission are:

1. Pages one and two of the admission application form should be completed by the candidate.

2. Attach a certified check or money order in payment of the matriculation fee of $25. (See p. 00 for explanation.)

3. The whole application form should then be submitted to the office of the candidate's secondary-school principal, with the request that his office fill out pages three and four and mail the completed application directly to the Director of Admissions.

It is required that this procedure be accomplished by March 1, if the candidate wishes to be considered for admittance to classes beginning the next September. It is the responsibility of each individual applicant to ensure that his application has been properly completed and sent to the Committee at the Institute before March 1.

4. The candidate should make direct application to the *College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey,* with a request to take certain examinations described below under the heading *Requirements.*

5. Each applicant must submit to a complete health examination by his family physician. A certificate of good health, indicating the date of this examination, must then be sent by the physician to the Director of Admissions. The Committee has prepared a special form for the convenience of the physician; a copy of this certificate of health will be supplied.

6. A personal interview with the Director of Admissions is strongly recommended. The Office of Admissions at the Institute is open for this purpose Monday through Friday, from 8:30 a.m. to 4:00 p.m. during the school year. *It is urged that appointments for an interview be made in advance.*

REQUIREMENTS

Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision, as to the eligibility of an applicant shall be left to the discretion of the Committee on Admissions.

The conditions under which an applicant may be accepted are as follows:

1. A candidate for admission must be a graduate of a secondary school approved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of equal standing.

2. (a) Because of the specialized nature of the various curricula at Lowell Textile Institute, it has been deemed advisable that all entering students shall have completed the following units of secondary-school study:

Algebra (quadratics and beyond)	2 units
Plane Geometry	1 unit
English	4 units
American History	1 unit
Chemistry (including laboratory)	1 unit
or	
Physics (including laboratory)	1 unit

Preference will be given to applicants offering both chemistry and physics. In addition to the above-listed prerequisites, each applicant must offer credit in elective subjects, such as: languages, other than English; history, other than American; mechanical drawing, solid geometry; advanced algebra; scientific subjects; social studies, and others. Trigonomerty is recommended but not required.

(b) The combined prerequisites and electives should total at least 15½ Carnegie units. Each such unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week, or the equivalent.

(c) In evaluating the credits offered by an applicant for admission, the Committee will be guided primarily by the quality of his scholastic record and by his apparent promise on grounds of intellect and character. There fore, an applicant whose preparation has not followed the normal pattern with respect to the accumulation of unit credits should not hesitate to apply for entrance, provided that the quality of his scholarship gives evidence of ability to do college work and provided that he is recommended by his school. (For additional information, see paragraph "Exceptions to Admissions Rules" below.)

3. Each candidate for admission to Lowell Textile Institute has full responsibility to arrange for and complete certain of the tests given by the College Entrance Examination Board. Arrangements for taking these tests should include a clear statement to the Board that the candidate desires that a special copy of the test results be forwarded to the Director of Admissions, Lowell Textile Institute.

Entrance requirements demand that the following tests be taken:

(a) Morning Program—The Scholastic Aptitude Test (Verbal and Math Sections) (three hours).

(b) Afternoon Program—an Achievement Test in each of the following:
Physics *or* Chemistry
Intermediate Mathematics

These examinations are prepared, administered, and graded independently of the Lowell Textile Institute. Therefore, as explained under Procedure, application to take the tests must be made directly to the College Entrance Examination Board, P.O. Box 592, Princeton, New Jersey. Arrangements to take the tests, which are scheduled annually for the early part of March, should be completed as early as possible in the candidate's senior year in secondary school. Foreign students, particularly, should plan to make early arrangements, so that testing facilities can be set up near their homes. The examinations are given

at various cities throughout the world, so that no candidate should be placed under undue hardship in taking the tests.

Questions concerning the nature and scope of the tests, the location of testing centers, financial considerations, and the like, should be addressed directly to the College Entrance Examination Board.

Exceptions to Admission Rules—In special cases, at the discretion of the Faculty Committee on Admissions, applications may be accepted from candidates in the following categories:

1. Applicants who lack credit in specified required subjects because they are not offered in the course of study at their secondary school. Such applications will be considered only when the quality of work done in other departments is exceptionally high.

2. Applicants who offer credit in all the required subjects, but whose accumulation of unit credits does not total 15½. Very few students will find themselves in this category, because most secondary schools require at least 15½ units for graduation. However, the Committee is willing to recognize the possibility that a student, well-qualified in all other respects, should not be denied the opportunity to submit his application because of purely quantitative considerations.

3. Applicants who have not maintained a uniformly good scholastic average in all subjects, *but are otherwise acceptable*, may be required to pass certain tests given by the College Entrance Examination Board. These tests will be in subjects prescribed by the Committee on Admissions, and usually will be in addition to the examinations regularly required of all candidates.

4. Applicants from secondary schools which are not on an accredited list may be required to pass the tests of the College Entrance Examination Board in those subjects prescribed by the Committee on Admissions, in addition to, or in substitution of, the tests regularly required all candidates.

TRANSFER STUDENTS

Transfer students are expected to have demonstrated outstanding ability, must submit transcripts of their college record and letters of honorable dismissal, and must supply cogent and positive reasons for wishing to enroll at Lowell Textile Institute. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

Because of the nature of the course of study at the Institute, it is usually difficult for a transfer student to construct a program which will be completely satisfactory. In general, a transfer can be accomplished only at the expense of sacrificing some time and credit. With that thought in mind, the Committee entertains consideration of advanced standing applications only when they include a well-developed plan of study, which the candidate submits as being acceptable and suitable for his purpose. The Director of Admissions and/or the Registrar will gladly advise prospective applicants concerning this plan of study, and other matters concerned with advanced standing, by means of correspondence, or interview, or both.

Occasionally, an undergraduate may leave the Institute to study elsewhere after which he wishes to return to the Institute. Re-entry under such conditions is by no means automatic. Each application will be considered in the light of its individual merits. Credit for courses taken at other institutions will be given wherever feasible, but the Faculty reserves the right to require that candidates for re-admission take such subjects as it deems necessary in the construction of a sound program, even though the course material may have been previously studied. Since each individual case is different, no hard-and-fast rule can be laid down, but in general, credit will be given only when good or superior work has been demonstrated.

SPECIAL STUDENTS

Although most applicants for admission will wish to enroll for the full four-year degree program, a few persons may wish to take specialized work without regard for degree credit.

Special students usually are expected to conform to the general rules and regulations as specified by the Faculty. Their plan of study may not be of such a nature as to deviate markedly from the regularly formulated subject matter and laboratory courses; and acceptance to special status is contingent upon the consent of the instructor in charge of each course to which admittance is sought.

The Committee admits only a few highly qualified students to special status each year. For detailed information concerning specific programs, applicants should communicate directly with the Director of Admissions.

FOREIGN STUDENTS

Each year the Lowell Textile Institute accepts for admission foreign applicants up to 5% of the total number of students in any given class (freshman, sophomore, etc.). There are no special procedures to be observed by foreign candidates, although it is urged that they endeavor to have the transcript of their secondary-school and/or college records, as well as all other admission materials submitted, in English, *not less than twelve months in advance of the expected date of enrollment.* All applicants should have a considerable facility in speaking and writing English, and have financial resources sufficient at least for their first year of study. Foreign students will be expected to complete the same schedule of courses as is assigned to all other students.

It is suggested, as noted above, that early arrangements be made with the College Entrance Examination Board to have a testing center located near the candidate's home. In all other respects, the admission procedures for foreign students are identical with those required of U. S. citizens.

To facilitate their adjustment to the life of the campus, undergraduate foreign students are regularly assigned room space, shared jointly with American students, in the residence halls of the Institute. Graduate students spend at least their first year at the Institute in a residence hall room. Students attending for the first time should note that towels, sheets, pillowcases, and blankets must be supplied by occupants of rooms. Students are therefore reminded that bedding, as well as clothing, should be suitable for a climate in which temperatures normally fall well below the freezing point during the winter months.

RESIDENCE HALLS

The Board of Trustees has stated the policy that the residence halls shall be completely occupied. Therefore, the following rules have been established to accomplish these ends.

1. All male students are required to live in the residence halls unless excused in writing by the Dean of Students. While such excuses are normally granted for the academic year, they are subject to review at the beginning of each semester and may be cancelled should conditions require.

2. Application for permission to occupy other living quarters will be made on special blanks available at the Dean of Student's office. An application must be filed annually by each student. Deadlines for filing applications are: (a) for all new students (incoming freshmen, transfer students, special students, or graduate students—on or before September 1 of each year; (b) for all regularly enrolled students—on or before June 1 of each year.

3. In granting special permission, the Dean of Students will give full consideration to the following:

a. Distance from Institute to place of legal residence.
b. Financial hardships involved in living in residence hall.
c. Year of the student (freshman, sophomore, junior, senior, graduate).
d. Membership in fraternities that maintain a fraternity house.

Rooms are adequately furnished and are cared for by the students occupying them. Sheets, pillowcases, blankets, towels, and other personal linens must be supplied by each student. Each occupant is held responsible for any damage done to furniture and equipment.

Assignments of rooms in the residence halls are made through the Office of the Dean of Students. All assignments are for the full academic year. Change of room is not permitted except under unusual circumstances, and may be accomplished only after a formal application has been approved by the Dean of Students.

All rentals are uniform, the annual rate being $275.00 per year for each student.

Assignments of rooms are made as equitably as possible and in the order that applications are received. For those students who are unable to be placed in residence halls, the Dean's Office supplies a list of approved rooming houses where students may reside.

ORIENTATION

Each freshman is expected to be in daily attendance beginning Wednesday, September 10, at 8:30 a.m., and to follow the prepared program which will be placed in his hands at that time. Late registration for all students at the Institute is subject to a five-dollar fine, unless accompanied by a medical or equally acceptable excuse.

Freshman Week—Freshman Week will be devoted to facilitating the adjustment of the beginning student to his new physical and social surroundings. Under the sponsorship of the Committee on Student-Faculty Relations, a program of meetings, lectures, and conferences will be presented in order to acquaint the entering class with the traditions, customs, rules and regulations, courses of instruction, organizations, recreational and other facilities of the Lowell Textile Institute.

Faculty Advisers—During Freshman Week, each entering student will be assigned a member of the faculty who will serve as his faculty adviser for the next two years. The advisers function as a counseling link between the student and his academic and personal problems.

Freshman Orientation Program—All new students at the Institute are required to attend the program of Freshman Orientation. Meetings are held once each week for two semesters. While the program carries no credits, it is designed to assist the freshman to make the adjustment to college life, and to teach him how to get the most out of his work at the Institute by efficient use of his time and talents. The work of the second semester attempts to develop his ability to think for himself, and to react thoughtfully and intelligently to ideas and viewpoints expressed in topics assigned for discussion.

GUIDANCE

A committee of faculty members supervises a guidance program which begins with the admission procedures, continues throughout the undergraduate years, and culminates in the work of the Placement Office.

Because living on-campus is an important aid in helping the new student adjust to college life, it is required that all freshmen and sophomore students, except those who have permission to live at home or in fraternity houses, take residence in the dormitories.

Guidance in the freshman year stems mainly from the results of the admissions testing program, Freshman Week activities, the Effective Study course, and the work of the Faculty Advisers. These same advisers function throughout the sophomore year, but during the junior and senior years the heads of departments and the Office of the Dean of Students take over primary responsibility for the students' personal and scholastic welfare.

The Office of the Dean of Students is open to all undergraduates at all times to assist the student in attaining his academic objective, and to assure his active, enjoyable participation in the work and affairs of the Institute.

The Placement Office functions as a natural outgrowth of the undergraduate guidance program. This office endeavors to keep Institute graduates in constant contact with the latest developments in the textile and allied industries, so that they may place themselves in positions best suited to their talents and abilities.

HEALTH SERVICE

The Dispensary, in Smith Hall, is in charge of a registered nurse eight hours each school day. She is on call 24 hours daily, including weekends. Students receive first aid treatment at the Dispensary, and are advised as to the best procedures in case of illness.

The college physician is on call 24 hours daily. If any student requires hospitalization, the college physician will arrange for admission to one of the three excellent, modern hospitals located in the immediate vicinity of the Institute. Medical fees and hospital charges are at the expense of the student.

Low-cost Group Accident and Sickness Insurance is also available to all students on a strictly voluntary basis.

STUDENT EXPENSES

The various student expenses described in this section apply only to the regular day school of Lowell Textile Institute. The fees and expenses of the Lowell Evening Textile School are described in a separate bulletin. All fees are established by the Board of Trustees and are subject to change without advance notice.

Payment of tuition and fees is an integral part of the registration process which must be completed before a student may attend classes. In special cases, a delay in the payment of fees may be authorized but all fees *must be paid* on or before the close of the sixth week of classes of the semester involved. Requests for delay must be approved *before* a student's registration is complete.

Matriculation Fee (First year of registration only.) $25

Payable by certified check or money order and filed with application for admission.

a. If application is rejected, the entire amount will be refunded.

b. If application is accepted and student enrolls, $15 will be credited toward the tuition for the first year.

c. If application is accepted but applicant gives written notice of withdrawal before September 1, $15 will be refunded.

Tuition—The yearly tuition fees are:

Residents of the Commonwealth of Massachusetts	$150
Non-residents	$250
Foreign students	$500

Students who are classified by the United States Immigration Authorities as "Displaced Persons" will pay non-residents' tuition of $250.

Special students pay, in general, the full tuition fee. However, if enrolled in only a limited number of courses, a special student may make application to the President for a reduction in tuition.

Residence: As defined by The Board of Trustees—

Because Lowell Textile Institute is a state-supported institution, its educational program and facilities are made available at a low tuition rate to students entering from the Commonwealth. Eligibility for admission as a resident entitled to the low residential tuition is determined under policies established by the Board of Trustees.

a. Every student claiming residence in Massachusetts must file with the Bursar a certificate signed by either the town or city clerk of the community claimed as legal residence, stating that the student's parents, or guardian, are legal residents of the Commonwealth of Massachusetts.

b. The residence of a minor shall follow that of the parents, unless the minor has been emancipated. A minor student who has been emancipated shall, in addition to the requirements respecting residence, present satisfactory documentary evidence of emancipation.

c. A minor under guardianship shall be required to present satisfactory documentary evidence of the appointment of a guardian in addition to the certificate of residence of the guardian.

d. A student shall not be considered to have gained residence in the Commonwealth of Massachusetts by reason of attendance at Lowell Textile Institute, nor shall a student lose residential preference during continuous attendance at the Institute.

e. The residence of a wife shall follow that of the husband.

f. The prescribed form of application for classification as to residence shall be executed for each student. Misrepresentation of facts to evade payment of the proper rate of tuition shall constitute sufficient cause for suspension or permanent separation from the Institute.

g. Payment of one-half of the total yearly tuition will be made during the registration for each semester.

h. The President of the Institute is authorized to adjust individual cases within the spirit of these rules.

Excess Hour Fee . . . . $12.50 per credit hour

A charge for each credit hour in excess of the number of credit hours officially prescribed for the course and semester in which the student is enrolled.

ROTC Deposit $25

This deposit covers loss of damage to uniform or equipment used for ROTC instruction. Required of al students enrolled in ROTC. The entire amount, less charges, will be refunded upon the completion of the ROTC requirements. If, at any time, the charges against a student exceed the amount on deposit, the student wil be required to pay such charges and to make an additional deposit of $25.

Activity Fee $30

Each student will pay, at his first registration for each academic year, an activity fee of $30.00. The payment of this fee entitles the student to free admission to all athletic events, a mailbox in the campus postoffice, a subscription to the student newspaper, and a copy of the yearbook. A portion of this fee helps to support the general student activities under the jurisdiction of the Student Council.

General Breakage Deposit $15

To cover all breakage or damage to Institute property, including residence halls.

Residence Halls $275

All students, except those who live in Lowell or the surrounding community, may be required to live in one of the residence halls, (see page 21 for details). The double rooms rent for $275 per student per year. One-half of the rent ($137.50) is payable at the start of each semester.

Laboratory Charges

a. Freshman Chemistry Fixed charges, $15; breakage deposit, $10	$25/year
b. Advanced Chemistry Fixed charges, $15; breakage deposit $10	$25/semester
c. Textile Finishing Fixed charges, $20	$20/year
d. Machine Tool Laboratory Fixed charges, $10; breakage deposit, $5	$15/year
e. All Manufacturing Laboratories (Textile, Paper, Leather, etc.) Fixed charges, $5	$ 5/year

All laboratory charges must be paid before students can be admitted to laboratory work. The unexpended balance of all deposits will be retained as a credit against laboratory charges incurred in subsequent semesters. Upon

graduation or withdrawal from the Institute any unused portion remaining to the student's credit will be refunded.

COMMENCEMENT FEE (Payable at beginning of senior year.) . . . $15

Covers commencement expenses such as diploma and case, rental of cap and gown, ten invitations per student, printing and other incidentals.

LATE REGISTRATION FEE $5

Any student who does not complete his registration (including the payment of all fees) by the close of the registration period stated in the Institute calendar may be required to pay an additional fee of $5.00.

OFFICIAL TRANSCRIPT FEE $1/copy

Each student will be allowed free of charge a total of three transcripts of his scholastic record. A charge of $1.00 per copy will be made for each *additional* transcript.

BOOKS AND MATERIALS—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement, but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments, or other property of the Institute loaned to the students are to be removed from the premises except by special permission.

SUMMARY OF EXPENSES PER YEAR

Matriculation Fee	$ 25
Tuition (resident of Massachusetts)	150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Dormitory rate per year	275
Excess Hour Fee (per hour)	12.50
Laboratory Charges	
a. Freshman Chemistry	25
b. Advanced Chemistry	50
c. Textile Finishing	20
d. Machine Tool Laboratory	15
e. All Manufacturing Laboratories	5
Student Activity Fee	30
ROTC Deposit	25
General Break Deposit	15
*Books and supplies	50
Commencement Fee	15
Late Registration Fee	5
Official Transcript Fee	1

*Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.

STUDENT SCHOLARSHIPS

SCHOLARSHIPS:—A limited number of scholarships is available to students of Lowell Textile Institute through funds contributed by various companies representing the textile or allied industry.

A. Administered by the Committee on Scholarships

1. *Fiberglas Scholarships—sponsored by the Owens-Corning Fiberglas Corporation.*

This scholarship is awarded annually to an outstanding sophomore in any of the textile courses. It pays the recipient full tuition and $500 per academic year for each of the junior and senior years. Selection is based upon academic record, character, qualities of leadership, and need.

2. *Russell L. Brown Scholarship—donated by Davis and Furber Machine Company*

Open to a student acceptable to Lowell Textile Institute who plans to enroll in the curriculum of Textile Engineering or Wool Yarn Manufacturing. Preference given to employees and sons or grandsons of employees of Davis and Furber Machine Company. Selection based on general scholarship, initiative, and need. Stipend $300. Appointments are for one year only but are renewable.

3. *Ralph E. Hale Scholarship of the Northern New England Section of the American Association of Textile Chemists and Colorists (1947).*

Established by the Northern New England Section of the American Association of Textile Chemists and Colorists in memory of Ralph E. Hale, 1951 Chairman-elect of the Section. This scholarship is awarded annually to a student at the completion of his or her junior year in the course in Chemistry, Textile Coloring, and Finishing. The amount of the scholarship is $250 per year.

4. *The McLaurin-Jones Scholarship—donated by the McLaurin-Jones Company*

This scholarship is awarded annually to a member of the Brookfield or Ware High School graduating class or to an employee of the McLaurin-Jones Company for work in the Paper Engineering Department. The scholarship for $500 is renewable from year to year for four years dependent upon a satisfactory scholastic record being maintained.

Applications for the above scholarships must be filed not later than February 1 with the Dean of Students.

B. Administered by the Agency Designated

1. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Association make available several scholarships a year which cover tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

2. *Berkshire Fine Spinning Associates, Inc. Scholarships*

A number of scholarships covering tuition and living expenses for four years are offered in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employees of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

3. *The Gehring Foundation Memorial Scholarship—in memory of Henry G. Gehring and his son, Edward H. Gehring,* both of whom were engaged in *the Lace Industry.*

These scholarships are made possible as a result of the Gehring Memorial Foundation of New York, the James T. and Steven E. Smith Memorial Funds, the Warwick Chemical Foundation Scholarship Fund in memory of Walter Nowicki, and other scholarships presented and designated by various textile companies.

Application should be made through the Alumni Office, Lowell Textile Institute.

4. *Goodall-Sanford, Inc. Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Successful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

Application should be made to Goodall-Sanford, Inc., Scholarship Committee, Sanford, Maine.

5. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination to students who qualify for entrance to Lowell Textile Institute under the terms described in the ADMISSION section of this Bulletin. All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 68 South Main Street, Providence, Rhode Island, no later than January 15, 1953. Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

6. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Association selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

7. *United Elastic Corporation Scholarships*

Scholarships in the amount of $150 are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. Other residents of the communities where plants are located, however, may enter applications for consideration. Preference is given to native New Englanders and to those who agree to work summers in approved mills.

Qualifications for scholarships include: good character and standing in the community, aptitude for technical training, and ability to pass entrance requirements of Lowell Textile Institute, and/or with the approval of the United Elastic Corporation and the Lowell Textile Institute, scholarships may be awarded to deserving upperclassmen.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following graduation.

All applications should be made through the plant nearest to residence of applicant. Plants are located at Easthampton, Lowell, and Littleton, Massachusetts; West Haven, Connecticut; and Stuart, Virginia.

8. *Jacob Ziskind Memorial Scholarship*

Established by the employees of the Merrimack Manufacturing Company in memory of Jacob Ziskind.

Qualifications include: Good character, scholastic record, initiative and ability to pass the entrance examination at Lowell Textile Institute.

Preference in granting the scholarship will be given employees of the Merrimack Manufacturing Company or members of their immediate families residing in the Greater Lowell area. However, other residents of Greater Lowell may enter applications for consideration.

The Merrimack Manufacturing Company will, in so far as possible, provide suitable on-the-job training during the summer vacation period and following graduation.

The scholarship provides tuition, books, supplies and such deposits as are required to properly enroll the student in the course selected.

C. Administered by the Agency Designated in Collaboration with the Committee on Scholarships

1. *New England Paper Merchants Association Scholarship—donated by the Association*

This scholarship, open to any student in the Paper Engineering Department who is a resident of New England, is awarded on the basis of scholarship and general character. The amount of the scholarship is $150.

2. *Boston Paper Trade Association Scholarship—donated by the Association.*

This scholarship, open to any student in the Paper Engineering Department who is a resident of New England, is awarded on the basis of scholarship and general character. The amount of the scholarship is $150.

3. *H. Webster Thomas Memorial Scholarship—donated by the Rohm and Haas Corporation*

This scholarship is awarded for a four-year period to a student in Leather Engineering at Lowell Institute. Established by Rohm and Hass Corporation as a memorial to H. Webster Thomas. The amount of the scholarship is $500 per year.

Application for the above scholarships should be filed with the Dean of Students not later than February 1.

FELLOWSHIPS

A. Open only to graduates of Lowell Textile Institute

1. *Lowell Textile School Followship—sponsored by the Proprietors of the Locks and Canals on the Merrimack River.*

Pays tuition for graduate work at Massachusetts Institute of Technology.

2. *Textron Fellowship—sponsored by Textron, Inc.*

Annual stipend of $1800 to $2400. Recipient may elect to do graduate work or take one year of practical training in representative mills of the textile industry. Application should be made to the Scholarship Committee of Lowell Textile Institute.

B. Open to graduates of textile schools.

1. *Clark Thread Company Fellowship*

Stipend: $1200 and tuition. For graduate work at Massachusetts Institute of Technology.

2. *New England Textile Foundation Graduate Fellowship*

Stipend: $1000 plus tuition. For graduate work at Massachusetts Institute of Technology.

3. *Textron Fellowship*

Stipend: $1200. For graduate work at Massachusetts Institute of Technology.

Further information on these four fellowships is given in the catalog of Massachusetts Institute of Technology.

LOAN FUND

A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning six months after the date at which the student officially leaves school. Repayments are not required until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $5.00 per quarter the first year and $10.00 per quarter each year thereafter until the loan is repaid. Additional payments may be made at any time so as to reduce indebtedness at a more rapid rate.

STUDENT AWARDS

The following awards are given annually at Commencement:

1. *The Cotton Medal.*—Given by the National Association of Cotton Manufacturers to that member of the graduating class in the courses of Textile Engineering (General Option) or Cotton Yarn Manufacture who has maintained the highest scholastic standing throughout the four years of his undergraduate work.

2. *Book Prize.*—Given by the American Association of Textile Chemists and Colorists to the outstanding graduating senior in the course of Chemistry, Textile Coloring, and Finishing. The recipient is selected by the Chemistry Department and the academic standing of the candidates is an important factor. The awards includes also a junior membership for one year in the A.A.T.C.C.

3. *Louis A. Olney Book Prizes.*—Selected reference books are awarded annually to the outstanding freshman, sophomore, and junior students in the course of Chemistry, Textile Coloring, and Finishing. The recipients are selected by the Department of Chemistry and the academic standing in the subjects of their major field for the past year is an important factor.

4. *Phi Psi Award.*—This award is given annually to an outstanding member of the graduating class in a Textile course on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

5. *American Association of Textile Technologists Award.*—Given annually by the American Association of Textile Technologists, Incorporated, to a member of the Senior Class who graduates in any textile course. Recipients are selected upon the basis of scholarship, technical ability, industry, judgment, leadership, reliability, and ability to work with others.

STUDENT LIFE

Lowell Textile Institute believes that sound educational practice seeks to develop the whole personality of the student. Accordingly, Faculty and Administration encourage extra-curricular activities and support the development of a varied and well-rounded program of activities to supplement the purely academic phase of undergraduate life. This program provides opportunity for participation in formal and informal sports; in class and campus self-government; and in the many clubs and special interest activities which appeal to the varied interests of the student body.

ATHLETICS

Under the supervision of the President and the Faculty, the Athletic Association promotes an extensive varsity and intramural sports program. By virtue of their payment of the Student Activity Fee, all students are members of the Athletic Association and receive free admission to all intercollegiate contests played at home. Basketball and baseball teams compete with teams throughout the Northeast. Golf, soccer, lacrosse, and ski teams also compete regularly with other colleges.

Intra-mural sports are sponsored by the Director of Intramural Athletics. This program includes both league and informal competition between the classes, residence halls, and the fraternities.

STUDENT GOVERNMENT

The Student Council is the chief body for the conduct of self-government in student affairs. It is composed of four officers elected at large by the student body, and the president and a representative elected by each of the four undergraduate classes.

By virtue of its function as chief governing body for student affairs, it exercises administrative control over all campus organizations formed under its supervision; represents the student body in matters requiring conference with the Administration and Faculty; investigates grievances submitted by students or student groups; sponsors all-campus dances, banquets, and other social affairs; and supervises the expenditure of the unallocated portion of the Student Activity Fee. It functions in accordance with the specific prescriptions of its Constitution and By-Laws.

SCHOLASTIC HONOR SOCIETY

Tau Epsilon Sigma is the scholastic honor society at Lowell Textile Institute. Election is open only to seniors who have been on the Dean's List for six consecutive semesters, or who have maintained an honor standing for four years, without any failure.

CLUBS

The following clubs maintain a prominent position in the extra-curricular life of the campus:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. The Engineering Society
3. International Club—for foreign students
4. Rifle Club—which participates in intercollegiate matches.
5. Band
6. Newman Club
7. B'nai B'rith Hillel Counsellorship
8. Arnold Air Society—Honorary ROTC Society

DRAMATICS

The Textile Players constitute the center of all dramatic activities of the campus. For years, the annual productions of this group have been a high point in the social calendar of the institute.

PUBLICATIONS

The TEXT is the campus newspaper. Prepared and edited by a student staff, this bi-weekly publication offers excellent journalistic and business experience to those who work on its staff.

The PICKOUT is the annual yearbook of the campus. Those who serve on the staff secure a vauable training in the editorial, art, and business problems involved in the production of a top-quality picto-literary history of an academic year. Supported by allotments from the Student Activity Fee.

GREEK LETTER SOCIETIES

Five Greek letter social groups have been granted official recognition by the Administration of Lowell Textile Institute.

The four fraternities, located in their own quarters, are as follows: Delta Kappa Phi, Omicron Pi, Phi Psi, and Pi Lambda Phi. The activities of these fraternities are co-ordinated through membership in the Interfraternity Council.

The sorority, Phi Sigma Rho, provides a center for the social life and mutual association of the young women studying at the Institute.

STUDENT RULES AND REGULATIONS

Students admitted to Lowell Textile Institute are assumed to be ladies and gentlemen, and of sufficient maturity and poise to enable them to live in an adult environment. Such living involves full respect for the rights of others, a regard for self-discipline and good order, and a high standard of honesty and of moral conduct.

In consequence of these assumptions, the regulations are framed not to restrict the conduct of individuals or groups of students, but, rather, to set forth the basic policies of the Faculty established in order that a large student body may live and work harmoniously together with a minimum of friction and misunderstanding. By the same token, even though the rules are neither detailed nor comprehensive, a student may be dropped from the rolls, or subjected to other disciplinary action, for conduct which is illegal, immoral, or inimical to the best interests of the Institute, regardless of whether or not the particular offense is listed in these rules and regulations.

ATTENDANCE

Attendance is expected of all students at all classes. The supervision of student attendance is lodged in the Office of the Dean of Students, both as to the announcement of detailed instructions, and as to the enforcement of the rules established by the Faculty. Students charged with unexcused absences, particularly absences immediately before and after holiday and vacation periods, are subject to disciplinary action.

DISCIPLINARY ACTION

Disciplinary action originates in the Office of the Dean of Students. Such action may be in the form of any of the following degrees of severity: Censure, Restriction, Suspension, or Dismissal. Whenever disciplinary action is taken, a notation of such action becomes a part of the permanent record of the student.

GRADES

For the Classes of 1953 and 1954, semester grades are reported, by letter, as follows:

H 90-100, 5 points
C 80-89, 4 points
P 70-79, 3 points
L 60-69, 2 points
F 50-59, 1 point (condition—entitled to re-examination)
FF Below 50, failure (no credit unless subject is repeated)

The student's semester rating is a weighted value used to denote his relative standing. It is dependent upon the point value of his final grade and the credit hours allotted to the subject. To compute, the point value of the final grade is multiplied by the credit hours carried by the subject. The total of the calculated values is divided by the sum of the credit hours. The result is the student's semester rating. The cumulative rating covers two, or more, semesters, and is computed by the procedure followed in computing the rating for a single semester.

For the Class of 1955, and those following, semester grades are reported, by letter, as follows:

A 90-100, 4 points
B 80–89, 3 points
C 70–79, 2 points
D 60–69, 1 point
F Below 60, Failure
I Incomplete
W Withdrawn
X Dropped

SCHOLASTIC REPORTS

Reports of scholastic standing are compiled regularly at the end of each semester. Unsatisfactory mid-semester grades are submitted to the office of the Dean of Students for guidance purposes, but formal notification of each student's status is made only at the conclusion of each semester.

DEAN'S LIST

The Dean's List is composed of those students who have a semester rating of 4.00 (3.00, new system) or higher, with no current failures.

PROBATION

A student is placed on probation when his semester rating is below 2.26 (1.25, new system). The probationary period covers the entire semester following the issuance of the semester rating which placed the student on probation.

A student with a rating of less than 2.26 (1.25, new system) for two consecutive semesters shall be dropped from the Institute for at least one semester.

A student on probation may not represent the Institute in any public function and may not hold class or other offices during his term of probation.

If a student receives a semester rating below 1.00 (0.50, new system), he may automatically be dropped from the Institute without benefit of a probationary period.

REQUIREMENTS FOR GRADUATION

Only those students who have satisfied the following minimum requirements will be recommended for the baccalaureate degree:

1. Successfully completed one of the curricula prescribed for this degree (see Pages 40 to 53) with a cumulative point average of at least 2.5.
2. No substitutions for subjects required to be taken in the major department;
3. Substitutions may be presented for subjects required in fields outside of the major department, provided such substitutions are approved by the Dean of Students, are in the same area of learning, require an equivalent amount of time for their completion, and, if not taken at the Institute, the credit is acceptable to the Registrar's Office and the Department Head concerned. For this purpose, the Registrar will not accept transfer credit when the grades are less than P, nor include such transfer credits when calculating the cumulative average.

GRADUATION HONORS

Academic honors are awarded at the annual Commencement Exercises by appropriate notation on the diploma for the baccalaureate degree, and by printing in the commencement program the names of students who have earned such recognition. Honors are awarded according to the following standards of achievement:

a. Any student who graduates with a rating of 4.00—4.49 (3.00—3.49, new system) for the entire period of study at L.T.I. shall be awarded the baccalaureate degree "With Honors".

b. Any student who graduates with a rating of 4.5 (3.5, new system) or better, for the entire period of study at L.T.I. shall be awarded the baccalaureate degree "With High Honors".

c. The highest ranking student in each graduating class who graduates with a rating of 4.8 (3.8, new system), or better, and who has completed at least six semesters of work at L.T.I. shall be awarded the baccalaureate degree "With Highest Honors".

THE AIR FORCE ROTC UNIT

An Air Force Reserve Officers Training Corps unit was established at the Lowell Textile Institute on July 1, 1951. Instruction began with the opening of the first semester of the academic year 1951-52.

By vote of the Board of Trustees, all able-bodied male students enrolling in Lowell Textile Institute for the first time on or after September 13, 1951 must satisfactorily complete the basic ROTC work (freshman and sophomore years) before receiving a Bachelor of Science degree. The President of the Institute may waive this requirement and permit the substitution of an equivalent amount of work only for those individuals who are not liable to military service under existing laws and regulations (for example, not a citizen of the United States, previous military service, etc.).

Uniforms and all equipment and textbooks required for the ROTC work will be supplied by the United States Air Force. Students in the Advanced Course will receive the standard cash payment allowed by the Air Force in lieu of subsistence.

The Mission and Purpose of the Air Force ROTC Unit at the Lowell Textile Institute

The mission of the AF-ROTC unit is to develop in each cadet those attributes essential to his progressive advancement to a commission as a Second Lieutenant in the United States Air Force Reserve and further, to prepare him to fill positions of increasing responsibility as a commissioned officer in such duties in the Air Force as may be required by the national defense effort.

The AF-ROTC program takes into consideration the fact that many of the academic subjects in which Lowell Textile Institute students are enrolled have as much direct relationship to military duties as they have to a civilian career. The courses contained in the AF-ROTC curriculum have been carefully selected to augment those academic subjects. The purpose of this course of instruction, then, is to enhance the otherwise high qualifications of the student with a thorough Air Force background.

GENERAL INFORMATION

The work covered in the first two years is considered as the Basic Course. In addition to exercises in leadership and drill, this work includes classroom instruction in World Political Geography, General Plans for the Defense of the

Air Force ROTC Review

Military Ball

Review for Honor Cadets

United States, Aerial Navigation, Meteorology, Aerodynamics, and Applied Air Power. As stated above, the satisfactory completion of the Basic Course is a requirement for the Bachelor of Science degree in all courses offered at the Institute. Cadets who satisfactorily complete the Basic Course may apply for the Advanced Course, which leads, upon graduation, to a commission as a Second Lieutenant in the Air Force Reserve.

The Advanced Course, consisting of the last two years of ROTC instruction supplemented by a summer camp, is designed to train the cadet in a specialized area for which the Air Force has a definite requirement. Only those cadets who are selected to receive this training may enroll in the Advanced Course. Two specialized areas of training are offered at Lowell Textile Institute—the General Technical Option and the Armament Option.

The General Technical Option is designed to train the cadet in the methods of operation and procedures used by the techncal specialist when functioning as an Air Force Officer. The instruction given in the General Technical Option is aimed toward the utilization of the graduate in a Technical Military Occupational specialty which is in accord with his educational background. Since a strong educational background in the physical sciences and mathematics is required, cadets who are taking any of the degree courses offered at the Institute are qualified to enroll in the General Technical Option.

The Armament Option is designed to train the cadet to fulfill the duties of an Armament Officer with the Air Force. These duties require an extensive knowledge of the various types of armament used by the Air Force, such as guns, rocket launchers, bombing and fire-control systems, guided missiles, and pilotless aircraft. Since an engineering background is required to master the subject readily, enrollment in the Armament Option is limited to only those cadets who registered in one of the strictly engineering curricula of the Institute, i.e., Textile Engineering (either Engineering or General Manufacturing Option), Leather Engineering or Paper Engineering.

In addition to completing satisfactorily the subjects required in one of these options, each cadet enrolled in the Advanced Course is required to supplement his training by attending a summer camp of approximately five week's duration. Usually, this camp is attended during the summer preceding his senior year. Transportation from the legal residence of the cadet to the camp and return, uniforms, food, lodging, and medical and dental care are provided by the Air Force and, in addition, the cadet receives the pay of a basic Airman.

Upon graduating from the Institute each cadet who has completed satisfactorily the Advanced Course of the AF-ROTC wil receive a commission as a Second Lieutenant in the United States Air Force Reserve.

Contributions of the AF-ROTC to the Student Life

In addition to the military and academic phases of its program, the Department of Air Science and Tactics sponsors various extra-curricular activities which are designed to produce a well-rounded cadet. Much of this activity will be undertaken by the Arnold Air Society.

The Arnold Air Society

The Air Force Association sponsors this military fraternity at all colleges that have an AF-ROTC program. The purpose of the Arnold Air Society is to unite selected Advanced AF-ROTC Cadets by a fraternal bond in support of a common cause—the Air Age. It is expected that a chapter of this society will be established at the Institute during the coming year. When established, the Arnold Air Society will be responsible for a cadet sport program and a variety of social affairs during the academic year, culminating in a military week-end

which will feature a colorful drill ceremony and have as its climax the formal Military Ball. One of the outstanding events of the Military Ball is the naming of the Honorary Cadet Officers.

Periodically, the Department of Air Science and Tactics conducts field trips to various Air Force installations for the purpose of orientation. They frequently include range firing and conducted tours of the base. Sometimes, a familiarization flight is added. Efforts are made also to assist those cadets who are interested in flying to gain as much information as possible about the operational phase of the Air Force.

The AF-ROTC Rifle Team is a member of the National Rifle Association and the New England College Rifle League. In addition to competing in a full schedule of intercollegiate rifle matches, the team competes each year against all of the AF-ROTC units in the First Air Force for the FIRST AIR FORCE TROPHY and all of the AF-ROTC units in the nation for the WILLIAM RANDOLPH HEARST TROPHY.

The AF-ROTC Band is composed primarily of cadets who are musicians or who desire to learn to play a band instrument. In addition to providing the music for the ROTC ceremonies, the band adds considerably to the color and life of the campus by participating in various Institute and civic programs.

Cadet Decorations and Awards

A number of medals are awarded to selected cadets and cadet officers at a special Parade and Review held each spring. The Honorary Cadet Colonel and/or her aides present these awards.

Air Force Association Medal—Normally awarded to the outstanding cadet of the senior class on the basis of his military record for the entire four years of the ROTC program. By special arrangements with the Air Force Association, this medal was awarded during the Year 1951-1952 and will be awarded in 1952-53 to the outstanding cadet of the Institute's ROTC unit.

Alumni Association Medal—Awarded to the most outstanding cadet, regardless of class, for exemplary achievements in academic, military, and extra-curricular activities. This medal is given by the Lowell Textile Institute Alumni Association.

Distinguished Commander Medal—Awarded to a cadet holding the rank of Major or higher for outstanding performance.

Distinguished Squadron Commander Medal—Awarded to a cadet holding the rank of Captain or higher for outstanding performance in leadership and drill.

Distinguished Flight Leader Medals—Awarded to two cadet lieutenants for outstanding performance in leadership and drill.

Distinguished Non-Commissioned Officer Medals—Awarded to the three Cadet Non-Commissioned Officers who have distinguished themselves by their excellence in leadership and drill.

Distinguished Cadet Medals—Awarded to the three cadets of the second-year Basic Course who have distinguished themselves through their work in leadership and drill.

In addition to the above medals all cadets are eligible to compete for the following:

Arnold Air Society Scholarship—A scholarship of $100 is awarded periodically to a selected member of one of the Arnold Air Society Squadrons in the First District. The basis for selection is the financial need of the cadet coupled with his academic and military record.

Distinguished Military Graduates—Each year certain AF-ROTC graduates are selected to receive this honor. The bases of selection are:

(a) Qualities of military leadership.
(b) High moral character.
(c) Aptitude for military service.
(d) Excellence in academic standing and/or outstanding leadership in campus activities.

A Distinguished Military Graduate may be offered a commission as a Second Lieutenant in the United States Air Force.

M.I.T.-L.T.I. COOPERATIVE PLAN

A cooperative plan of operation between these two institutions has been agreed upon. The major provisions include: (1) the mutual use of the facilities for research and manufacturing in Lowell Textile Institute and the Massachusetts Institute of Technology, Textile Division, for student theses, both graduate and undergraduate; (2) the mutual use of the textile libraries of both institutions; (3) the opportunity, open to students in each institution, to supplement their education by taking work available in the other; (4) the formation of joint seminars and the exchange of staff members for special lectures; and (5) frequent student visits and joint meetings of student societies.

THE CO-OPERATIVE EDUCATION PLAN

In 1948, Lowell Textile Institute formally adopted the Co-operative Plan of Education, on a voluntary basis, wherein those students who elect the plan, and who pass the competitive selection process successfully, spend three summers in the textile, leather, or paper industries on a planned work-study basis.

Work opportunities are available to a limited number of students, beginning at the end of the freshman year and continuing each summer thereafter until graduation. It is the aim of this program to give to participating student certain educational experiences that cannot be obtained in school and yet which are vital to the background of the technically trained college graduate, such as contact with machines and people in a production environment; development of an awareness of jobs and the impact of mass production methods on the personality of labor; knowledge of the interplay of the different fields of study covered in school in the successful operation of business. It is also hoped that by working in the industry early enough in his career, the student can judge more clearly and more thoughtfully whether or not he has been wise in choosing a technical career.

This group meets informally throughout the year to discuss work experiences and to hear lectures by leaders in the textile industry.

PLACEMENT OFFICE

The Institute maintains a central placement office which has three functions:

1. To assist in the placement of graduating students.

2. To assist in the up-grading of alumni and/or to help each alumnus attain a position yielding a maximum of satisfaction and happiness.

3. To assist industry in the increasingly difficult job of locating trained and experienced personnel.

The Placement Office is concerned solely with positions effecting the graduating student; it does not attempt to place undergraduates in part-time or summer employment.

4. Administration of the Co-operative Education Plan.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry, Master of Science in Textile Engineering, and Master of Science in Textile Manufacturing to graduate students who satisfactorily complete a program of advanced standing. Recently, authority has been granted to include Master of Science work in the fields of Paper Engineering and of Leather Engineering which will lead to corresponding degrees.

The graduate programs of study offered by the Institute provide for advanced specialized training required by technologists who contribute to industrial progress and human welfare through the application of scientific and engineering principles to existing industrial and human problems. The courses of study allow the graduate of the Institute or of other colleges training men in textile, paper, or leather technology to broaden his knowledge and skills in these areas and to develop a sound research approach to problems of the basic sciences, the development of new products, and industrial production.

I. Admission to the Graduate School

A. *General Admission*

To be eligible for admission to the Graduate School, an applicant must have received a Bachelor's degree in an acceptable four-year course in which he has maintained a uniformly high scholastic rating. Both quality and quantity of the previous training will be considered. Selection of those applicants admitted will be based as far as possible on their ability to pursue graduate work of high quality.

B. *As a Provisional Graduate Student*

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfies the department in which he wishes to enroll that he is probably able to pursue graduate studies successfuly.

The status of such a student will be changed to that of a graduate student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of (2.5) (80%).

C. *Application Procedure*

Those wishing to carry on graduate studies at this Institute should file application with the Director of the Graduate School. Applications may be obtained from the Office of the Graduate School.

Applications for admission should be complete and accurate and must be received not later than the fifteenth of April preceding the fall term in which the applicant wishes to enroll. Applications must be supported by letters from at least two persons qualified to judge the ability of the applicant to carry on graduate work and research. The letters should be sent directly from these persons to the Graduate School.

Transcripts of all undergraduate records (and graduate, if any) must be sent directly to the Office of the Graduate School by the institutions which the applicant has previously attended. All transcripts must be official, with appropriate seals and signatures. Records, descriptions and subjects, and letters must be in English. Each subject must be described in terms of content, scope, number of hours per week, and number of weeks duration. Lecture and laboratory time should be properly distinguished.

Except in unusual circumstances, applications will be acted upon and the applicant notified of the decision by June 1, following the receipt of the application.

II. Graduate Courses Offered

Graduate work is offered in the fields of Textile Chemistry, Textile Engineer-eng, Textile Manufacturing, Paper Engineering and Leather Engineering. For the academic year 1952-1953, there will be only a limited amount of graduate work in Textile Manufacturing and no work in Paper or Leather Engineering.

Because of the varied objectives of the graduate student, the course of study is arrived at through consultation with the student's graduate advisor.

III. Term of Residence

Applicants with a sufficient background in their chosen field of concentration will normally require one academic year of residence to complete the requirements for the Master's degree. Those with no background will require a minimum of two years of residence.

IV. Thesis Requirements

A thesis must be submitted by each candidate for a Master's degree in partial fulfillment of the requirements. The thesis must be an original investigation on a suitable topic in the student's major field approved by the faculty advisor and the department head.

COURSES OF STUDY

Lowell Textile Institute offers ten curricular options leading to the degree of Bachelor of Science. The first semester of the first year's work is common to all curricula. With the start of the second semester of the first year, the student is permitted to undertake a limited amount of specialized work in his chosen field. However, for the first two years the instruction given in all curricula is sufficiently concentrated on fundamentals so that a student may change from one curriculum to another with a minimum loss of time.

Each of the ten curricula is presented in outline form on the following pages. Shown for each semester are the required subjects, the credit-hour value of each subject, and the total credit-hour load. *In general one credit hour represents one hour of lecture-recitation work or approximately three hours of laboratory work.* A description of each subject will be found in the section "Subject Descriptions" in which the subject fields are listed alphabetically.

FIRST YEAR, FIRST SEMESTER (common to all curricula)

				Credit Hours
Chem.	101	General Inorganic Chemistry	(4-3)	5
Eng.	111	Engineering Drawing	(0-6)	2
Engl.	101	English Composition and Literature	(3-0)	3
Math.	103	College Mathematics	(3-0)	3
Phys.	101	Physics	(4-1)	4½
		Orientation	(1-0)	0
		Physical Education	(0-1)	0
A.S.	101	Basic ROTC	(2-1)	2
		or		
S. Sci.	101	World Economic Geography	(2-0)	2
		and		
		Physical Education	(0-1)	0
			Total	19½

COURSE I—COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or of textiles produced from any staple fibre utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to process rayon, wool, and other staple fibers is considered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

Laboratory work consists of a series of experiments planned to give the student a good acquaintance with the equipment and its use for spinning, weaving, and finishing cotton materials. Most of the laboratory equipment is

full-sized commercial machinery such as the graduate will meet in his industrial experience. Laboratory work is generally synchronized with the lectures to demonstrate and supplement lecture instruction.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

*A.S.	201	Basic ROTC	(2-1)	2
Cot.	201	Cotton Carding	(3-2)	4
Cot.	211	Cottons	(1-6)	3
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
				21

*Alternate for ROTC

Des.	262	Color	(1-1)	2

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	202	Cotton Carding	(3-2)	4
Cot.	222	Cot. Waste Proc.	(1-6)	3
Des.	222	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Des.	112	Handloom Weaving	(0-3)	1
Des.	122	Perspective	(0-2)	1

Third Year

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	301	Cot. Spinning	(2-3)	3
Cot.	311	Staple Fib. Mfr.	(1-2)	1½
Des.	223	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Tex.	311	Textile Testing	(2-2)	3
Weav.	211	Weav. for Mfrs.	(2-2)	2½
Wool	311	Surv. of Wool Mfrs.	(3-1)	3
**Electives				3 or 4
				20 or 21

*Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Cot.	302	Cotton Spinning	(2-3)	3
Cot.	322	Cot. Qual. Control	(1-2)	1½
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	212	Weav. for Mfrs.	(2-2)	2½
**Electives				3 or 4
				20 or 21

*Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Engl.	202	Speech	(2-0)	2
Engl.	212	Business English	(1-0)	1

Fourth Year

Cot.	401	Mill Organization	(4-0)	4
Cot.	411	Major Project		1½
Eco.	351	Textile Marketing	(2-0)	2
Fin.	421	Cot. & Synth. Fin.	(2-3)	3
Knit.	401	Knitting	(2-5)	4
Weav.	311	Weav. for Mfrs.	(2-2)	2½
**Electives				4
				21

*Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
Cot.	411	Major Project		4

Cot.	402	Management Prob.	(2-0)	2
Cot.	412	Major Project		4
Eco.	412	Indus. Management	(3-0)	3
Fin.	422	Cot. & Synth. Fin.	(2-3)	3
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
Weav.	312	Weav. for Mfrs.	(2-2)	2½
*Electives				4
				20

*Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Cot.	412	Major Project		4

COURSE II—WOOL MANUFACTURE

The course in Wool Manufacturing is planned for students who contemplate a career in the industries utilizing the wool fiber, or using the woolen, worsted, or felt systems of machinery to process fibers of any type. The student studies all fibers and all basic processing systems, but emphasis is given to the wool fiber and its manufacture. Instruction is also given in both lectures and laboratory on the reprocessing of fibers, rag-picking, and garnetting. Through the use of the Pacific Converter the processing of synthetic tow to top and yarns is studied. The latest equipment for superdraft drawing and spinning, a Holdsworth Gill Reducer, a Warner-Swasey Pin Drafter, and other modern equipment is available for laboratory work.

The purpose of the Wool Manufacturing course is to train students for executive positions in any of the branches of the wool industry. It is planned for those who are chiefly interested in the production and processing phases. A thorough engineering and scientific background is part of the course in order to enable the student to understand better the application of engineering principles as applied to both textile machines and processes.

A maximum amount of time is devoted to the professional or textile subjects. Laboratory experiments are planned to train the student in the method of analyzing machines, as well as tests, settings, adjustments and the elimination of faulty work. With wool now being manufactured on cotton machinery, a study in Survey of Cotton Manufacture is offered in order that the student may know the similarities and differences of the wool and cotton systems. Synthetic fiber processing in the woolen and worsted systems is studied and laboratory work includes the actual processing of staple rayon and other manufactured fibers alone or blended with wool. Courses in economics, speech, business administration, labor problems, etc., are offered to prepare better the student to assume a position of responsibility and leadership, both in the industry and in his community.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	102	Elem. Tex. Des.	(2-1)	2
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Physical Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Physical Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Des.	232	Fabric Des. & Anal. for Mfrs.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
Weav.	211	Weaving for Mfrs.	(2-2)	2½
Wool	211	Top Making	(2-6)	4
				20½

*Alternate for ROTC

S.Sci.	461	Personnel Mgmt.	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Des.	233	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
Weav.	212	Weaving for Mfrs.	(2-2)	2½
Wool	212	Top Making	(2-6)	4
				20½

*Alternate for ROTC

Eng.	122	Machine Tool Lab.	(1-2)	1

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Engl.	211	Business English	(1-0)	1
Tex.	311	Textile Testing	(2-2)	3
Weav.	311	Weav. for Mfrs.	(2-2)	2½
Wool	301	Woolen Yarns	(2-4)	3½
Wool	321	Worsted Yarns	(3-5)	5
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	301	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	221	Eco. Hist.; the U.S.	(3-0)	3

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	312	Weav. for Mfrs.	(2-2)	2½
Wool	302	Woolen Yarns	(2-4)	3½
Wool	321	Worsted Yarns	(3-3)	4
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	302	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Engl.	222	Apprec. of Lit.	(3-0)	3

Fourth Year

Eco.	341	Accounting I	(3-0)	3
Eco.	351	Textile Marketing	(2-0)	2
Engl.	201	Speech	(2-0)	2
Fin.	401	Wln. & Wstd. Fin.	(2-3)	3
Knit.	403	Knitting	(2-3)	3
Wool	411	Woolen Mill Organ.	(4-0)	4
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	401	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Cot.	332	Cot. Yarn Mfg. Sur.	(3-1)	3
Eco.	412	Ind. Management	(3-0)	3
Eng.	212	Heat and Power	(2-2)	3
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Fin.	402	Wln. & Wstd. Fin.	(2-3)	3
Syn.	322	Fil. Yarn Proc. Sur.	(2-0)	1½
**Electives				3 or 4
				18½ or 19½

**Electives restricted to

A.S.	402	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	302	Mod. Labor Prob.	(3-0)	3

COURSE III—TEXTILE DESIGN

The prescribed curriculum of the Textile Design Course is especially planned to equip the student with the fundamentals of structural textile design. This type of designing of textiles is concerned with the building of a fabric. To this end the student should become fully conversant, through lectures and laboratory work, with the properties of natural and synthetic fibers, the different systems of yarn manufacture, various arrangements of yarns in fabrics, the methods used to execute designs in woven and knitted fabric, dyeing, the various finishing processes employed after fabrication, and the methods used for testing fabrics.

Emphasis is placed on subjects dealing with the analysis and designing of fabric structures, from the simplest plain fabric to the more complicated and elaborate. The broad scope of this curriculum provides, in addition to the more specific structural design objectives, subjects in the sciences, liberal arts, and management.

The graduate of the Textile Design Course, though more specifically equipped as a structural textile designer, is qualified to enter into other branches of the textile industry according to his aptitudes and opportunities.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	104	Yarn Calculation	(1-0)	1
Des.	106	Elem. Tex. Des.	(3-1)	3
Des.	112	Handloom Weav.	(0-3)	1
Eng.	104	Mechanism	(2-0)	2
Eng.	114	Eng. Drawing	(0-3)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Des.	203	Tex. Des. & Fab. Anal.	(3-2)	4
Des.	251	Color	(1-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
Weav.	201	Weaving	(2-4)	3½
				21½

*Alternate for ROTC

Engl.	201	Speech	(2-0)	2

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Des.	121	Perspective	(0-2)	1
Engl.	212	Business English	(1-0)	1
Des.	204	Tex. Des. & Fab. Anal.	(3-2)	4
Des.	252	Color	(1-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
Weav.	202	Weaving	(2-4)	3½
				21½

*Alternate for ROTC

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	331	Cot. Yarn Mfr. Sur.	(3-1)	3
Des.	211	Tex. Des. & Fab. Anal.	(2-2)	3
Des.	301	Tex. Des. & Fab. Anal.	(2-2)	3
S.Sci.	341	Accounting I	(3-0)	3
Weav.	301	Weaving	(2-4)	3½
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	301	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	311	Psychology	(3-0)	3

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Des.	212	Tex. Des. & Fab. Anal.	(2-2)	3
Des.	302	Tex. Des. & Fab. Anal.	(2-2)	3
Tex.	302	Fabrics	(3-0)	3
Weav.	302	Weaving	(2-4)	3½
Wool	312	Sur. of Wool Mfr.	(3-1)	3
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	302	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
		A Social Science elective		

Fourth Year

First Semester

Des.	311	Tex. Des. & Fab. Anal.	(2-2)	3
Des.	411	Jacquard Des. & Weav.	(1-2)	2
Eco.	351	Textile Marketing	(2-0)	2
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Knit.	403	Knitting	(2-3)	3
Tex.	311	Textile Testing	(2-2)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	401	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	201	Mod. Eco. Prob.	(3-0)	3

Second Semester

Des.	312	Tex. Des. & Fab. Anal.	(2-2)	3
Des.	402	Adv. Tex. Des. & Anal.	(2-1)	2
Fin.	412	Woolen & Wstd. Fin.	(3-3)	4
Syn.	322	Fil. Yarn Proc. Sur.	(2-0)	1½
S.Sci.	302	Mod. Labor Prob.	(3-0)	3
Tex.	312	Textile Testing	(2-2)	3
**Electives				3 or 4
				19½ or 20½

**Electives restricted to

A.S.	402	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Eco.	412	Ind. Management	(3-0)	3

COURSE IV—CHEMISTRY, TEXTILE COLORING, AND FINISHING

This curriculum is designed to train those who wish to engage in the bleaching, scouring, dyeing, printing, and finishing of textiles, or who are interested in the manufacture, demonstration, and sale of dyestuffs, detergents, and other chemicals used in the textile industry. Students having difficulty in color perception, while unfitted for employment in dyehouses or with dyestuff concerns, are capable of having a successful career in other branches of Textile Chemistry.

This course provides a basic training in chemistry, physics, and mathematics. To this is added theoretical and practical training in bleaching, dyeing, printing and finishing, given in the junior and senior years. Since it is assumed that the students will eventually have executive or supervisory positions, they are required to take courses in English and speech to provide a background for report writing and the expression of ideas. Courses in the humanities are also required in the hope that with a broader training the graduate will become a more valuable member of his community as well as a success in his chosen profession. German is offered students intending to study for advanced degrees.

First Year

First Semester					*Second Semester*				
Refer to Page 40					*A.S.	102	Basic ROTC	(2-1)	2
					Chem.	104	Gen. Inorg. Chem.	(3-0)	3
					Chem.	122	Qual. Analysis	(1-6)	3
					Chem.	124	Elem. Stoich.	(2-0)	2
					Eng.	104	Mechanism	(2-0)	2
					Engl.	102	Engl. Comp. & Lit.	(3-0)	3
					Math.	104	College Math.	(3-0)	3
					Wool	112	Surv. of Wool Mfrs.	(2-0)	2
							Orientation	(1-0)	0
							Phys. Ed.	(0-1)	0
									20
					*Alternate for ROTC				
					S.Sci.	102	World Eco. Geog.	(2-0)	2
							Phys. Ed.	(0-1)	0

Second Year

*A.S.	201	Basic ROTC	(2-1)	2	*A.S.	202	Basic ROTC	(2-1)	2
Chem.	201	Elem. Org. Chem.	(3-3)	4	Chem.	202	Elem. Org. Chem.	(3-3)	4
Chem.	211	Quant. Analysis	(1-6)	3	Chem.	204	Chem. Tech. of Fibers	(2-0)	2
Chem.	241	Stoichiometry	(1-0)	1	Chem.	212	Quant. Analysis	(1-6)	3
Cot.	231	Cot. Yn. Mfg. Surv.	(2-0)	2	Chem.	242	Stoichiometry	(1-0)	1
Math.	203	Math. for Chem.	(4-0)	4	Math.	204	Math. for Chem.	(4-0)	4
Phys.	201	Physics	(3-2)	4	Phys.	202	Physics	(3-2)	4
				20					20
*Alternate for ROTC					*Alternate for ROTC				
Ger.	201	Tech. German	(3-0)	3	Ger.	202	Tech. German	(3-0)	3

Third Year

Chem.	311	Tex. Quant. Anal.	(1-3)	2	Chem.	322	Textile Chemistry	(2-3)	3
Chem.	321	Textile Chemistry	(2-3)	3	Chem.	332	Phys. Chemistry	(3-3)	4
Chem.	331	Phys. Chemistry	(3-1½)	3½	Chem.	362	Gen. Colloid Chem.	(2-0)	2
Des.	101	Elem. Tex. Des.	(2-1)	2	Eco.	202	Economics	(3-0)	3
Eco.	201	Economics	(3-0)	3	Tex.	302	Fabrics	(2-0)	2
Tex.	311	Textile Testing	(2-2)	3	Tex.	312	Textile Testing	(2-2)	3
**Electives				4 to 6	**Electives				4 to 6
				20½ to 22½					21 to 23
**Electives (select 4 to 6 cr. hrs.)					**Electives (select 4 to 6 cr. hrs.)				
A.S.	301 or 303	Adv. ROTC	(4-1)	4	A.S.	302 or 304	Adv. ROTC	(4-1)	4
Chem.	333	Indus. Chem.	(3-0)	3	Chem.	312	Tex. Quant. Anal.	(1-3)	2
Chem.	473	At. & Mol. Struct.	(2-0)	2	Chem.	342	Org. Qual. Anal.	(1-3)	2
Eng.	351	Expl. Appl. of Statistics	(3-0)	3	Chem.	352	Chem. Eng.	(3-0)	3
Ger.	201	Tech. German	(3-0)	3	Ger.	202	Tech. German	(3-0)	3

Note: Ger. 201 must be followed by Ger. 202.

Fourth Year

First Semester

Chem.	411	Adv. Tex. Chem. & Dyeing	(2-9)	5
Chem.	431	Macromol. Chem. of Tex. Proc.	(2-0)	2
Fin.	411	W. & W. Fin.	(3-3)	4
Eco.	351	Tex. Marketing	(2-0)	2
		or		
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3
**Electives				6
				19 or 20

**Electives

A.S.	401 or 403	Adv. ROTC	(4-1)	4
		Tech. or Prof. subjects as approved by the Dept. Head		2 or 6

Second Semester

Chem.	412	Adv. Tex. Chem. & Dyeing	(2-9)	5
Chem.	422	Adv. Chem. Tex. Test.	(2-3)	3
Fin.	432	Cot. & Syn. Fin.	(3-3)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
**Electives				6
				21

**Electives

A.S.	402 or 404	Adv. ROTC	(4-1)	4
		Tech or Prof. subjects as approved by the Dept. Head		2 or 6

COURSE V—SYNTHETIC TEXTILES

This curriculum is designed for students interested in those segments of the textile industry primarily devoted to the utilization of man-made fibers, with particular emphasis on continuous filament fibers. Silk, being a natural continuous filament fiber not covered in other manufacturing courses, is also considered.

The synthetic fiber phase of textiles is the most recent addition to the industry and found its origin in the various chemical research laboratories. Because of this, an understanding of the manufacture and utilization of synthetic fibers depends upon a sound training in chemistry, physics and mathematics. More emphasis is placed on chemistry than in the other manufacturing courses.

Realizing the importance of a broad college training for men entering the industry with the intention of eventually assuming some type of administrative position, specialization in textiles is limited to approximately forty percent of the total credit hour load. The remaining sixty percent of the studies are devoted to basic subjects, such as the fundamental physical sciences, English, the social sciences, and economics. Within the broad field of specialization in textiles, about one-half of the time is devoted to synthetic fibers, yarns, and textiles,

Graduates of this curriculum should be acceptable to the textile manufacturer, the synthetic fiber producer, and the graduate schools of the country.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	103	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19

*Alternate for ROTC

S.Sci.	102	World Econ. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester					*Second Semester*				
*A.S.	201	Basic ROTC	(2-1)	2	*A.S.	202	Basic ROTC	(2-1)	2
Chem.	201	Org. Chem.	(3-3)	4	Chem.	202	Organic Chem.	(3-3)	4
Chem.	221	Int. to Tex. Chem.	(2-0)	2	Chem.	222	Int. to Tex. Chem.	(1-3)	2
Des.	101	Elem. Tex. Des.	(2-1)	2	Des.	222	Fab. Des. & Anal.	(2-1)	2
Eco.	201	Economics	(3-0)	3	Eco.	202	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3	Math.	212	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4	Phys.	202	Physics	(3-2)	4
				20					20
*Alternate for ROTC					*Alternate for ROTC				
S.Sci.	221	Eco. Hist.; the U.S.	(3-0)	3	Engl.	222	Appr. of Lit.	(3-0)	3
					S.Sci.	212	World History	(3-0)	3

Third Year

Des.	303	Syn. Fab. Des. & Anal.	(1-2)	2	Cot.	332	Cot. Yn. Mfr. Surv.	(3-1)	3
Syn.	301	Fil. Yarn Proc.	(2-0)	2	Syn.	302	Throwing Plt. Org.	(2-0)	2
Syn.	311	Mfr. of Syn. Fibers	(3-0)	3	Syn.	312	Str. & Prop. of Syn. Fibers	(3-0)	3
Syn.	331	Fil. Yarn Lab.	(0-3)	1	Syn.	332	Fil. Yn. Lab.	(0-3)	1
Tex.	311	Textile Testing	(2-2)	3	Tex.	302	Fabrics	(2-0)	2
Weav.	211	Weaving for Mfrs.	(2-2)	2½	Tex.	312	Textile Testing	(2-2)	3
Wool	311	Surv. of Wool Mfr.	(3-1)	3	Weav.	212	Weaving	(2-2)	2½
**Electives				3 or 4	**Electives				3 or 4
				19½ or 20½					19½ or 20½
**Electives restricted to					**Electives restricted to				
A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4	A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4	A.S.	304	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3	S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

Fourth Year

Eco.	351	Textile Marketing	(2-0)	2	Eco.	412	Indus. Management	(3-0)	3
Eng.	431	Adv. Phys. Testing	(1-3)	2	Engl.	202	Speech	(2-0)	2
Fin.	431	Cot. & Syn. Fin.	(3-3)	4	S.Sci.	314	Phil. of Science	(3-0)	3
Knit.	403	Knitting	(2-3)	3	Syn.	412	Prop. & Appl. of Syn. Fibers	(3-0)	3
Syn.	411	Prop. & Appl. of Syn. Fibers	(3-0)	3	Syn.	452	Syn. Tex. Seminar	(2-0)	2
Weav.	311	Weav. for Mfrs.	(2-2)	2½	Weav.	312	Weaving	(2-2)	2½
**Electives				3 or 4	**Electives				3 or 4
				19½ or 20½					18½ or 19½
**Electives restricted to					**Electives restricted to				
A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4	A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4	A.S.	404	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	311	Psychology	(3-0)	3	Eco.	344	Prin. of Sel. & Adv.	(3-0)	3
S.Sci.	321	Comp. Mod. Govts.	(3-0)	3	Phys.	402	Textile Physics	(2-3)	3
S.Sci.	461	Personnel Mgmt.	(3-0)	3	S.Sci.	466	Management Prob.	(3-0)	3

COURSE VI—TEXTILE ENGINEERING

The concept of a textile engineer originated in 1905, and the first known curriculum in Textile Engineering appears in the Lowell Textile Institute catalog for 1905-06. Through the succeeding years the same general pattern has been followed in this training, modified from time to time, however, to recognize changing conditions in the industry and in educational ideas, but always embodying the same two fundamental foundations. A textile engineer is defined as one who has had a basic training in engineering to which has been added a thorough grounding in the manufacture of textiles, their properties and uses.

Two options are offered in Textile Engineering, viz., Engineering and General Manufacturing. It is the belief of the Engineering faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, e.g.,

chemistry, the ideal training for the textile industry combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, as well as an orientation to society and business through a selected core of liberal arts and economic subjects. Although the credit hour ratings, assigned to VI-E and VI-G are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

ENGINEERING OPTION—VI-E

The Engineering Option provides a training in Mechanical Engineering similar to that found in other engineering schools. To this is added a knowledge of Textiles sufficient to prepare the individual for positions in the textile and allied industries which may involve research and engineering principles. Business subjects and the humanities are included in the curriculum so that this type of textile engineer may have the educational potential to rise to a position of executive responsibility.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

*A.S.	201	Basic ROTC	(2-1)	2
Des.	101	Elem. Tex. Des.	(2-1)	2
Des.	103	Yarn Calculation	(1-0)	1
Eng.	201	Mach. Drawing	(0-3)	1
Eng.	221	Tex. Mechanism	(1-2)	1½
Eng.	233	Mach. Tool Lab.	(0-3)	1
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
Wool	311	Surv. of Wool Mfr.	(3-1)	3
				19½

*Alternate for ROTC

Engl.	201	Speech	(2-0)	2
Engl.	211	Business English	(1-0)	1

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	332	Cot. Yn. Mfr. Surv.	(3-1)	3
Des.	224	Fab. Des. & Anal. for Engrs.	(2-1)	2
Des.	234	Fab. Des. & Anal. for Engrs.	(2-1)	2
Eng.	222	Applied Mechanics	(3-0)	3
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
				20½

*Alternate for ROTC

Engl.	222	Apprec. of Lit.	(3-0)	3

Third Year

Eco.	201	Economics	(3-0)	3
Eng.	301	Adv. Appl. Mech.	(3-0)	3
Eng.	331	Mill Engineering *or*	(3-0)	3
Eng.	351	Expl. Appl. of Statistics		
Phys.	321	Electronics	(3-2)	4
Tex.	311	Textile Testing	(2-2)	3
Weav.	333	Weav. for Engrs.	(1-2)	1½
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		3

Eng.	302	Adv. Appl. Mech.	(3-0)	3
Eng.	312	Heat Engineering	(3-2)	4
Eng.	342	Prin. of El. Eng.	(3-2)	4
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Eco.	202	Economics	(3-0)	3

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eng.	401	Prin. of El. Eng.	(3-2)	4
Eng.	411	Adv. Ht. Eng.	(2-2)	3
Eng.	425	Eng. Des. of Tex. Structures	(2-0)	2
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Eng.	431	Adv. Phys. Test.		
		or	(1-3)	2
Phys.	401	Tex. Microscopy		
**Electives				3 or 4
				21 or 22

*Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Eco.	412	Indus. Management	(3-0)	3
Eng.	402	Tex. Appl. of Elec.	(1-4)	1
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Eng.	426	Eng. Des. of Tex. Structures	(2-0)	2
Fin.	412	W. & W. Finishing	(3-3)	4
Knit.	404	Knitting	(2-3)	3
		or		
Eng.	424	Machine Design	(2-2)	3
		or		
Math.	402	Diff. Equations	(3-0)	3
		or		
Phys.	402	Tex. Physics	(2-3)	3
**Electives				3 or 4
				18 or 19

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

GENERAL MANUFACTURING OPTION—VI-G

The objective of the General Manufacturing Option is to provide the textile industry with technically trained textile engineers. The curriculum has been planned so that the textile engineer (1) shall be given as complete and thorough a knowledge and understanding of the raw materials, machines, and processes peculiar to the manufacture of all fibers as is possible; (2) shall have a basic training in engineering and the fundamental sciences; and (3) shall acquire a knowledge of business and managerial principles and the social sciences.

The first component should prepare the student to be useful in any textile plant regardless of fiber processed. The second should develop a man who will approach textile problems from an engineering viewpoint thus contributing toward their solution the benefits of a trained analytical mind. Third objective should aid in the production of a well-rounded individual.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Eng.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Cot.	201	Cotton Carding	(3-2)	4
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
Wool	215	Top Making	(2-2)	3
				22

*Alternate for ROTC

Weav.	221	Weav. for Engrs.	(2-0)	2

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	202	Cotton Carding	(3-2)	4
Des.	224	Fab. Des. & Anal. for Engrs.	(2-1)	2
Des.	234	Fab. Des. & Anal. for Engrs.	(2-1)	2
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
Wool	216	Top Making	(2-2)	3
				21

*Alternate for ROTC

Weav.	222	Weav. for Engrs.	(2-0)	2

Third Year

First Semester				
Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	301	Cotton Spinning	(2-3)	3
Eng.	321	Str. of Mat.	(3-0)	3
Phys.	321	Electronics	(3-1)	3½
Tex.	311	Textile Testing	(2-2)	3
Weav.	333	Weav. for Engrs.	(1-2)	1½
Wool	323	Woolen Yarns	(2-2)	2½
		or		
Wool	325	Worsted Yarns	(3-2)	3½
**Electives				4
				22½ or 23½

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester				
Chem.	222	Int. to Tex. Chem.	(1-3)	2
Cot.	302	Cotton Spinning	(2-3)	3
Eng.	344	Elec. Machinery	(3-2)	4
Tex.	312	Textile Testing	(2-2)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
Wool	324	Woolen Yarns	(2-2)	2½
		or		
Wool	326	Worsted Yarns	(3-2)	3½
**Electives				4
				20 or 21

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Fourth Year

Cot.	401	Mill Organization	(4-0)	4
Eco.	341	Accounting I	(3-0)	3
Eng.	311	Prin. of Ht. Eng.	(3-2)	4
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Eng.	431	Adv. Phys. Test.		
		or	(1-3)	2
Phys.	401	Tex. Microscopy		
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Eco.	412	Indus. Management	(3-0)	3
Eng.	402	Tex. Appl. of Elec.	(1-4)	1
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Engl.	212	Business English	(1-0)	1
Fin.	412	W. & W. Finishing	(3-3)	4
Knit.	404	Knitting	(2-3)	3
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
**Electives				4 or 5
				19½ or 20½

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Engl.	202	Speech	(2-0)	2
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

COURSES VII—TEXTILE SALES AND MANAGEMENT

This course is designed for those interested in the marketing and management phases of the textile and allied industries. Its emphasis is on all three branches of management—production, distribution, and finance. The student is given a fundamental knowledge of the natural sciences and their application to the processing of all types of textile fibers. This scientific and manufacturing background is increasingly essential to effective merchandising and management, particularly at the higher levels of supervision. A substantial amount of time is also devoted to cultural subjects designed to broaden the student's outlook, increase his understanding of social and economic problems, and improve his ability to get along with people.

First Year

First Semester

Refer to Page 40

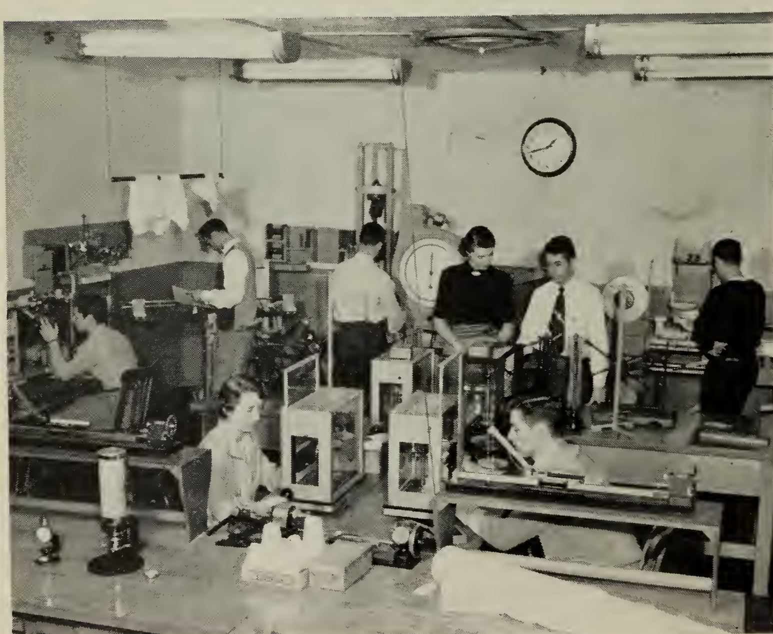
Second Semester				
*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	102	Elem. Tex. Des.	(2-1)	2
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

NEW PAPER AND LEATHER ENGINEERING BUILDING

Meeting of Students' Chapter of American Association of Textile Chemists and Colorists



Fay Foto Service, Inc., Boston

Textile Testing Laboratory

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Des.	222	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Des.	251	Color	(1-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
Weav.	333	Weav. for Engrs.	(1-2)	1½
Wool	311	Surv. of Wool Mfr.	(3-1)	3
				20½

*Alternate for ROTC

Elective approved by Head of Dept.		2

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Des.	223	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Des.	252	Color	(1-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
S.Sci.	222	Man & His Envir.	(3-0)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
				20½

*Alternate for ROTC

Elective approved by Head of Dept.		2

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	331	Cot. Yn. Mfg. Surv.	(3-1)	3
Des.	232	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	311	Eco. Statistics	(3-0)	3
Eco.	321	Prin. of Marketing	(3-0)	3
Tex.	311	Textile Testing	(2-2)	3
**Electives				4
				20

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Des.	233	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	322	Prin. of Marketing	(3-0)	3
Eco.	344	Prin. of Sel. & Adv.	((3-0)	3
S.Sci.	314	Phil. of Science	(3-0)	3
Tex.	312	Textile Testing	(2-2)	3
**Electives				4
				20

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eco.	431	Selling Policies	(3-0)	3
Fin.	431	Cot. & Syn. Fin.	(3-3)	3
S.Sci.	311	Psychology	(3-0)	3
S.Sci.	463	Bus. Law	(3-0)	3
**Electives				4
				20

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester

Eco.	342	Accounting II	(3-0)	3
Eco.	412	Indus. Management	(3-0)	3
Fin.	412	W. & W. Finishing	(3-3)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
**Electives				4
				18½

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

COURSE VIII—PAPER ENGINEERING

The object of this course is to fit a man for work in the paper-making, paper-converting, or allied industries. For this, a thorough training in basic chemical engineering is offered, accompanied by instruction in the theory and practice of pulp and paper manufacture and paper converting. Paper engineering involves the application of cellulose and plastics chemistry together with engineering principles to the handling of the material in the web or sheet form, as it is treated, coated, or converted into the final product. Every effort will be made by cooperation with local concerns to supplement college work by experience in actual manufacturing conditions, thus giving the student an opportunity to familiarize himself with equipment commonly in use in the industry.

Students taking this course should be well equipped for work in the paper-making or paper-converting fields, or for graduate study in paper technology.

The curriculum outlined below should be regarded as provisional in character.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Chem.	112	Qual. Anal.	(2-3)	3
Chem.	124	Elem. Stoich.	(2-0)	2
Eng.	112	Eng. Draw.	(0-6)	2
Engl.	102	Engl. Com. & Lit.	(3-0)	3
Math.	104	Col. Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Org. Chem.	(3-3)	4
Chem.	213	Quant. Anal.	(2-6)	4
Math.	203	Math. for Chem.	(4-0)	4
Paper	201	Pulp & Paper Mfr.	(3-0)	3
Phys.	201	Physics	(3-2)	4
				21

*Alternate for ROTC

Ger.	201	Tech. German	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Org. Chem.	(3-3)	4
Eng.	104	Mechanism	(2-0)	2
Engl.	202	Speech	(2-0)	2
Math.	204	Math. for Chem.	(4-0)	4
Paper	202	Pulp & Paper Mfr.	(3-0)	3
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Ger.	202	Tech. German	(3-0)	3

Third Year

First Semester

Chem.	331	Phys. Chem.	(3-1½)	3½
Chem.	333	Indus. Stoich.	(3-0)	3
Paper	303	Wood Tech.	(3-3)	4
Phys.	321	Electronics	(3-1)	3½
S.Sci.	221	Eco. History	(3-0)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	301 or			
A.S.	303	Adv. ROTC	(4-1)	4
Eng.	351	Expl. Appl. of Stat.	(3-0)	3

Second Semester

Chem.	332	Phys. Chem.	(3-3)	4
Chem.	352	Chem. Eng.	(3-0)	3
Chem.	362	Gen. Colloid Chem.	(2-0)	2
Engl.	212	Business Engl.	(1-0)	1
Paper	312	Pulp. & Paper Test. & Anal.	(4-7)	6
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	302 or			
A.S.	304	Adv. ROTC	(4-1)	4
Paper	302	Pulp & Paper Mfr.	(3-0)	3

Fourth Year

First Semester

Paper	401	(Practice Work in Industry)		18
**Electives				2 or 4
				20 or 22

**Electives restricted to

A.S.	401 or			
A.S.	403	Adv. ROTC	(4-1)	4
Paper	403	Mat. of Const., Corrosion	(2-0)	2

Second Semester

Chem.	442	Adv. Chem. Eng.	(3-0)	3
Eng.	344	Elec. Machinery	(3-2)	4
Paper	404	Paper Coat. & Conv.	(3-0)	3
S.Sci.	222	Man & His Envir. *or*	(3-0)	3
S.Sci.	314	Phil. of Science		
S.Sci.	302	Mod. Labor Prob.	(3-0)	3
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	402 or			
A.S.	404	Adv. ROTC	(4-1)	4
Paper	414	Adv. Paper Prob.	(1-4)	3

COURSE IX—LEATHER ENGINEERING

The concept of a leather engineer is new to the leather industry. The economic size of this industry as well as the scope and number of its problems warrants the careful training of individuals capable of handling the specific problems which arise in this industry. The leather industry realizes that many of its products can be improved by the application of sound and intelligent research and development. The demand is growing for engineers having a basic understanding of the art of leather manufacturing.

In this curriculum, emphasis will be placed on the fundamentals of engineering, including mathematics, physics, chemistry, and theoretical and applied mechanics. These subjects are basic in any sound undergraduate program. Since the undergraduate student cannnt be left with a great collection of tools which he does not understand, subjects are offered in the application of their basic scientific principles to leather technology. In order to balance properly this program, subjects in general education are offered, since the engineer as well as being trained to be a leader in his profession must also be trained to be a leader in everyday economic, social, and political affairs. He must also be trained to meet success, promotion, and the challenge of directing the work of others.

The curriculum outlined below should be regarded as provisional in character.

First Year

First Semester

Refer to Page 40

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	104	Gen. Inorg. Chem.	(3-0)	3
Chem.	112	Qual. Anal.	(2-3)	3
Chem.	124	Elem. Stoich.	(2-0)	2
Eng.	104	Mechanism	(2-0)	2
Eng.	112	Eng. Drawing	(0-6)	2
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Elem. Org. Chem.	(3-3)	4
Chem.	213	Quan. Anal.	(2-6)	4
Engl.	201	Speech	(2-0)	2
Ger.	201	Tech. German	(3-0)	3
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
				23

*Alternate for ROTC

Eng.	201	Machine Drawing	(0-3)	1

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Elem. Org. Chem.	(3-3)	4
Engl.	212	Business English	(1-0)	1
Ger.	202	Tech. German	(3-0)	3
Lea.	202	App. Lea. Anal.	(1-6)	3
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Eng.	222	Applied Mechanics	(3-0)	3

Third Year

First Semester

Chem.	331	Physical Chem.	(3-1½)	3½
Chem.	335	Chem. of the Proteins	(3-0)	3
Eng.	321	Strength of Mater.	(3-0)	3
Lea.	301	Leather Mfr.	(3-6)	5
Lea.	303	Histo-Pathology of Animal Tissues	(1-6)	3
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Chem.	332	Physical Chem.	(3-3)	4
Chem.	362	Gen. Colloid Chem.	(2-0)	2
Lea.	302	Leather Mfr.	(3-6)	5
Lea.	304	Micros. in Tanning	(1-3)	2
Lea.	322	Tanning Mechan.	(3-0)	3
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Eco.	412	Ind. Management	(3-0)	3

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eng.	351	Exp. App. of Stat.	(3-0)	3
Lea.	401	Leather Mfr.	(3-6)	5
Lea.	411	Leather Problems	(1-6)	3
Phys.	321	Electronics	(3-1)	3½
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	463	Business Law	(3-0)	3

Second Semester

Eco.	468	Financial Mgmt.	(2-0)	2
Eng.	344	Elec. Machinery	(3-2)	4
Lea.	402	Leather Mfr.	(3-6)	5
Lea.	404	Prop. of Leather	(2-3)	3
Lea.	412	Leather Problems	(1-6)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Eng.	424	Machine Design	(2-2)	3

SUBJECT DESCRIPTIONS

1. First semester subjects are those ending in odd numbers.

2. Second semester courses are indicated by even numbers.

3. Subjects continuing throughout the year are indicated by hyphenated numbers.

4. The number of lecture-recitation and laboratory hours is indicated within the parentheses and the credit is shown outside. In the case of a year course, the credit shown is the total for the year. Example: (2-6)4 would mean 2 hours of lecture-recitation and 6 hours of laboratory for 4 credits; while a year course (2-3) (1-6)6 would indicate 2 hours of lecture-recitation and 3 hours of laboratory for the first semester followed by 1 hour of lecture-recitation and 6 hours of laboratory the second semester, for a total credit of 6.

5. The prerequisites for the various subjects are shown. No student can be officially registered in a subject until the indicated prerequisites have been satisfactorily completed.

6. Subjects numbered 100-199 are normally given at the freshman level.

   Subjects numbered 200-299 are normally given at the sophomore level.

   Subjects numbered 300-399 are normally given at the junior level.

   Subjects numbered 400-499 are normally given at the senior level.

   Subjects numbered 500 and above are restricted to graduate students.

   No subject below 300 may be counted toward the Master of Science degree.

SUBJECTS ARE LISTED ALPHABETICALLY BY SUBJECT CLASSIFICATIONS, IRRESPECTIVE OF THE DEPARTMENT INVOLVED.

AIR SCIENCE

As. 101-102 WORLD POLITICAL GEOGRAPHY AND LEADERSHIP AND DRILL (2-1)2

Required of all freshmen — CAPT. MESLE AND AF ROTC STAFF

World Political Geography provides the AF ROTC students with a general knowledge of political geography to serve as a background for subsequent Air Force subjects. Against a backdrop of the geography of the various world states, the student will learn some of the historical development of each nation and the part that its geography played in that development.

Leadership and Drill provides for the development in the student of the qualities of leadership and discipline essential to Air Force Officers and acquaints him with the fundamentals of drill.

As. 201-202 AIR POWER SUBJECTS AND LEADERSHIP AND DRILL (2-1)2

Required of all sophomores — CAPT. INGERSOLL AND AF ROTC STAFF

This subject covers the following: Defense of U. S., Aerial Navigation, Meteorology, Aerodynamics, Applied Air Power, Leadership and Drill.

As. 301-302 GENERAL TECHNICAL OPTION AND LEADERSHIP AND DRILL (4-1)4

Required of all Advanced Course AF ROTC Cadets selected for General Technical Option AF ROTC STAFF

General Technical Option covers Officer Development subjects, mission and functions of U. S. Air Force, new technical developments, Atomic Energy and Radiological Defense, and Air Force technical subjects.

As. 303-304 ARMAMENT OPTION AND LEADERSHIP AND DRILL (4-1)4

Required of all Advanced Course AF ROTC Cadets selected for Armament Option AF ROTC STAFF

Armament Option covers .50 cal. machine gun, 20 mm. auto. gun, Electronics, Fire Control Systems, Bombs and Accessories, Rockets, and Guided Missiles.

As. 401-402 GENERAL TECHNICAL OPTION AND LEADERSHIP AND DRILL (4-1)4

Required of all Advanced Course AF ROTC Cadets selected for General Technical Option AF ROTC STAFF

This is a new AF ROTC course and is presently being revised. In addition to Officer Development subjects it is expected to contain information relative to the latest technical and scientific developments.

As. 403-404 ARMAMENT OPTION AND LEADERSHIP AND DRILL (4-1)4

Required of all Advanced Course AF ROTC Cadets selected for Armament Option AF ROTC STAFF

This course covers Officer Development, Principles of Radar, Fire Control Systems, Theory of Bombing, and Radar Bombing Equipment.

CHEMISTRY

CHEM. 101 GENERAL INORGANIC CHEMISTRY (4-3)5

Required of all Freshmen PROF. CHACE AND STAFF

This subject is concerned with the basic principles of chemistry and a consideration of non-metallic elements and their compounds.

CHEM. 102 GENERAL INORGANIC CHEMISTRY (3-3)4

Prerequisite: CHEM. 101 PROF. CHACE AND STAFF

Required of all freshmen except those in Courses IV and IX

In this subject, attention is focused on metals and their compounds. In the laboratory, special emphasis is placed on textile applications.

CHEM. 104 GENERAL INORGANIC CHEMISTRY (3-0)3

Prerequisite: CHEM. 101 PROF. CHACE

Required of freshmen in Courses IV and IX

In this subject, attention is focused on the metals and their compounds and a continuation of the studies of the basic principles is made.

CHEM. 112 QUALITATIVE ANALYSIS (2-3)3

Prerequisite: CHEM. 101 PROF. DALEY

Required in Courses VIII and IX

This subject covers the systematic qualitative analysis of inorganic compounds through use of semi-micro technique.

Chem. 122 QUALITATIVE ANALYSIS (1-6)3
Prerequisite: Chem. 101 Prof. Daley
Required in Course IV Messrs. Brown and Lavrakas

This subject covers the systematic qualitative analysis of inorganic compounds through the use of semi-micro technique.

Chem. 124 ELEMENTARY STOICHIOMETRY (2-0)2
Prerequisites: Chem. 101, Math. 101 Prof. Daley
Required in Courses IV, VIII and IX Mr. Brown

The elementary calculations of inorganic chemistry and qualitative analysis.

Chem. 201-202 ORGANIC CHEMISTRY (3-3) (3-3)8
Prerequisite: Chem. 102 or 104 Prof. Scattergood
Required in Courses IV, V, VIII and IX Mr. Derby

This subject is a study of the industrial methods of preparation, properties, and mechanisms of reaction of important classes of carbon compounds together with the fundamental theories of organic chemistry. The laboratory work consists of the preparation of a representative member of each important series of organic substances.

Chem. 204 CHEMICAL TECHNOLOGY OF FIBERS (2-0)2
Prerequisite: Chem. 201 Mr. Peirent
Required in Course IV

A study of the chemical properties of the textile fibers and the resulting reactions with chemicals and dyes which are of technical importance. Both natural and artificial fibers are considered.

Chem. 211-212 QUANTITATIVE ANALYSIS (1-6) (1-6)6
Prerequisite: Chem. 122 Profs. Fickett and James
Required in Course IV

This subject covers the fundamental principles of quantitative analysis. The first semester emphasizes gravimetric analysis. Volumetric techniques are covered during the second semester.

Chem. 213 QUANTITATIVE ANALYSIS (2-6)4
Prerequisite: Chem. 112 Prof. James
Required in Courses VIII and IX

This subject covers the common analytical operations of gravimetric and volumetric analysis and the calculations involved.

Chem. 221 INTRODUCTION TO TEXTILE CHEMISTRY (2-0)2
Prerequisite: Chem. 102 Prof. Howarth
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This subect is designed for the non-chemist and consists of a series of lectures covering the various processes preliminary to dyeing. The preliminary treatments given the natural and manufactured fibers are covered as well as the action and properties of the textile chemicals used in these processes.

Chem. 222 INTRODUCTION TO TEXTILE CHEMISTRY (1-3)2
Prerequisite: Chem. 221 Profs. Howarth and Everett
Required in Courses I, II, III, V, VI-G and VII
Not open to students in Course IV

This is a continuation of Chem. 221. The application of the various classes

of dyes to the natural and manufactured fibers is covered. The methods of dyeing, the fastness properties of the different classes of dyes, and the nature and use of dyeing assistants is taken up. The principles covered in the lectures are illustrated by work in the laboratory.

CHEM. 241-242 STOICHIOMETRY (1-0) (1-0)2

Prerequisite: CHEM. 124 *and concurrent registration in* CHEM. 213 — PROFS. FICKETT AND JAMES

Required in Course IV

The subject matter presented parallels, in general, that given in CHEM. 213-214 with more detailed consideration being given to the mathematical calculations involved.

CHEM. 311 TEXTILE QUANTITATIVE ANALYSIS (1-3)2

Prerequisite: CHEM. 212 — PROFS. FICKETT AND JAMES

Required in Course IV

This subject is devoted to basic principles of chemical analysis covered in CHEM. 122 and 211-212 and to the examination of materials used in the textile mill, the dye house, and the finishing plant. Among the materials covered are water, oils, soaps, bleaching agents, etc.

CHEM. 312 or 313 TEXTILE QUANTITATIVE ANALYSIS (1-3)2

Prerequisite: CHEM. 311 — PROFS. FICKETT AND JAMES

This is a continuation of CHEM. 311. The analysis of such materials as vegetable, animal, lubricating, and sulfated oils is considered.

CHEM. 321 TEXTILE CHEMISTRY (2-3)3

Prerequisites: CHEM. 202, ENG. 104, PHYS. 202

Required in Course IV — PROFS. HOWARTH, EVERETT AND SCATTERGOOD

This subject is designed primarily for those majoring in chemistry and is the first of four semesters of work relating to the chemistry of all types of textile fibers i.e. cotton, wool, rayon, nylon, and synthetics. Lectures are given by Prof. Howarth on operations preliminary to dyeing. Lectures are given by Prof. Scattergood on the physical organic chemistry of dyes. Operations preliminary to dyeing are carried out in the laboratory.

CHEM. 322 TEXTILE CHEMISTRY (2-3)3

Prerequisite: CHEM. 321 — PROFS. HOWARTH AND EVERETT

Required in Course IV

This subject is a continuation of the work started in CHEM. 321. The following topics are discussed: Water in the Textile Industry, Theory of Dyeing, Coloring Matters, and Dyeing Processes.

CHEM. 331-332 PHYSICAL CHEMISTRY (3-1½) (3-3)7½

Prerequisites: CHEM. 242, MATH 202 OR 204 *and* PHYS. 202 — PROFS. CHACE AND LISIEN

Required in Courses IV, VIII and IX

A study of the important principles of physical chemistry, i.e., gaseous, liquid, solid states; elementary chemical thermodynamics; determination of molecular weights; viscosity; surface tension; etc.

Topics covered include dilute solutions, chemical equilibrium, phase equilibrium, free energy, and electrical properties of solutions.

CHEM. 333 INDUSTRIAL STOICHIOMETRY (3-0)3

Prerequisites: CHEM. 331 *taken concurrently* PROF. LEWIS

Required in Course VIII

This comprises the study of some important operations in the chemical industry, e.g., sulfuric acid, and in the pulp and paper industry from the standpoint of the application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Recirculatory processes will also be studied.

CHEM. 335 CHEMISTRY OF THE PROTEINS (3-0)3

Prerequisites: CHEM. 202 *and* CHEM. 331 *taken concurrently* PROF. CHOUINARD

Required in Course IX

A study of the chemistry of proteins with special emphasis on the collagen molecule.

CHEM. 342 ORGANIC QUALITATIVE ANALYSIS (1-3)2

Prerequisites: CHEM. 122 *and* 202 PROF. SCATTERGOOD, MR. DERBY

The purpose of this subject is to acquaint the student with the latest methods available for the determination of unknown organic compounds. Special methods for dyestuff analysis are discussed.

CHEM. 351 CHEMICAL ENGINEERING (3-0)3

Prerequisites: CHEM. 104, MATH. 203 *and* PHYS. 202 PROF. MASASCHI

Required in Course VIII

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying, with special emphasis on textile application and textile chemical machinery.

CHEM. 362 GENERAL COLLOID CHEMISTRY (2-0)2

Prerequisite: CHEM. 331 PROF. LEWIS

Required in Courses IV, VIII and IX

This subject covers the basic general principles of colloidal chemistry, followed by elementary analyses of important problems encountered in amorphous materials such as paints, cellulosic products, leather, paper, and textiles.

CHEM. 411-412 ADVANCED TEXTILE CHEMISTRY AND DYEING (2-9) (2-9)10

Prerequisite: CHEM. 322 PROFS. HOWARTH AND EVERETT

Required in Course IV

Continuation of CHEM. 321-322, covering (1) Color matching and color combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, and (5) Dye house management.

CHEM. 413 or 414 SPECIAL STUDIES IN DYEING (1-6)3

Prerequisite: CHEM. 412 *or permission of instructor* PROFS. HOWARTH AND EVERETT

A subject designed for those desiring more than the required work in dye application. Further work in dye application is given, also dye testing, color matching, and textile printing.

If the student has a particular problem in the application of dyes, time will be allotted for its study.

CHEM. 415 THEORY IN DYEING PRACTICE (2-0)2

Prerequisite: CHEM. 322 MR. PEIRENT

This course consists of a study of fundamental chemical and physical aspects of the dyeing of protein, cellulose, and synthetic fibers. Consideration is given to the reaction of dyes with fibers, effects on dyeing of chemical and physical variations in fibers, and of chemical and physical processing of fibers, and the effects of variations in industrial dyeing techniques.

CHEM. 422 ADVANCED CHEMICAL TEXTILE TESTING (2-3)3

Prerequisites: CHEM. 202, CHEM. 212, TEX. 311 PROF. MASASCHI

A series of lectures and laboratory periods designed to supplement the textile testing given in TEX. 311-312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content, and fiber damage is followed by some dyestuff identification. The use of optical equipment such as the colorimeter, pH apparatus, spectrophotometer, ultra violet radiation and infrared radiation is also studied.

CHEM. 431 MACROMOLECULAR CHEMISTRY OF TEXTILE PROCESSES (2-0)2

Prerequisites: CHEM. 332 *and* CHEM. 362 PROF. SKINKLE

Required in Course IV

The principles of general colloid chemistry are applied to specific textile applications. Wetting, detergency, the fibers themselves, dyes, and finishing processes are studied from the colloidal aspect.

CHEM. 441 ADVANCED CHEMICAL ENGINEERING (3-0)3

Prerequisite: CHEM. 352 STAFF

Required in Course VIII

An advanced study of the subjects covered in CHEM. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This is an elective continuation of CHEM. 352.

CHEM. 451-452 ORGANIC CHEMISTRY OF NATURAL AND SYNTHETIC POLYMERS (3-0) (3-0)6

Prerequisites: CHEM. 202, CHEM. 321, CHEM. 332

PROF. SCATTERGOOD

This subject presents the molecular structure of polymeric materials formed by addition, condensation, or natural polymerization.

The study of polysaccharides and proteins is introduced by a summary of the chemistry of the carbohydrates and amino acids. Special emphasis will be placed upon the study of polymeric materials used or potentially useful in the textile industry. Modified polysaccharides and proteins useful in the paper and leather industries will also be considered.

CHEM. 461 or 462 MICROBIOLOGY (1-3)2

Prerequisite: CHEM. 202 MR. BROWN

This subject considers the fundamentals of mycological and bacteriological theory briefly but in sufficient detail so that the problem of the microbiogical deterioration of textiles, paper, and leather may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance and bacteriological water analysis are also studied.

CHEM. 464 ADVANCED MICROBIOLOGY (1-3)2
Prerequisite: CHEM. 461 *or* 462 MR. BROWN

This work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc., are typical.

CHEM. 472 INORGANIC PREPARATIONS (2-3)3
Prerequisite: CHEM. 104 PROF. CHACE

The purpose of this subject is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

CHEM. 473 THE THEORY OF ATOMIC AND MOLECULAR STRUCTURE (2-0)2
MR. LAVRAKAS

A discussion of the old theory of atomic structure precedes the topic of wave mechanics and its application to atomic and molecular structure. The following topics are presented: The Hydrogen Atom, the Periodic Classification of the Elements, the Covalent Bond, Saturation and Direction of Valency Bonds, Resonance, Method of Molecular Orbitals, and Complex Compounds. In addition, about a fourth of the course is spent on the Hydrogen Bond and the Theory of Acids and Bases.

CHEM. 474 THE THEORY OF ATOMIC AND MOLECULAR STRUCTURE TEXTILE DYES AND FIBERS (2-0)2
MR. LAVRAKAS

The subject is a continuation of CHEM. 473. Papers are presented by the members of the class relating to dyes or fibers to the newer theories of atomic and molecular structure.

CHEM. 481 or 482 TRACER TECHNIQUES (1-3)2
Prerequisite: Permission of Instructor PROF. CHACE

Consideration is given to the use of radioactive substances as tracers. In the laboratory the fundamental techniques of counting, feather analysis, "hot lab." syntheses, radioautographs, etc., are covered. The safe handling of radioactive materials at the microcurie level will be stressed.

CHEM. 501 or 502 APPLICATION OF COLOR MEASUREMENT (1-2)2
Credits and hours to be arranged PROF. SKINKLE
Prerequisite: CHEM. 422 *of equivalent*

This subject covers the description and use of transmission and reflection colorimeters and also the spectrophotometers and recording spectrophotometer. The calculations from the results are studied and the use of the instruments in dye application research is thoroughly investigated.

CHEM. 503 INTERPRETATION OF DATA (2-0)2
PROF. SKINKLE

Mathematical methods of analyzing, plotting and interpreting experimental data, which lead to properly weighted quantitative results are studied by means of lectures and exercises.

CHEM. 506 PHYSICAL CHEMISTRY OF DYEING (2-0)2
PROF. SKINKLE

This is a combination of lectures and seminar sessions on the physico-chemical principles involved in the application of dyestuffs to textile materials.

CHEM. 508 METHODS OF DYE RESEARCH (1-2)2
PROF. SKINKLE

A series of conferences and laboratory periods are devoted to a survey of procedures necessary in fundamental dyeing studies.

CHEM. 511 or 512 SURFACE ACTIVE AGENTS (1-2)2
Credits and hours to be arranged PROF. SKINKLE
Prerequisite: CHEM. 431

A laboratory study, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial application.

CHEM. 521 or 522 TEXTILE TESTING PROBLEMS PROFS. SKINKLE AND MASASCHI
Credits and hours to be arranged
Prerequisite: CHEM. 422

Special problems relating to the design and evaluation of improved analytical or testing procedures.

CHEM. 525 or 526 EVALUATION OF FINISHING AGENTS (1-2)2
Credits and hours to be arranged PROF. MASASCHI

A laboratory study designed to teach the use of the various test methods and instruments in evaluating the effect of finishing treatments on the tactile and end-use properties of a fabric.

CHEM. 527 INSTRUMENTAL METHODS IN TEXTILE RESEARCH (1-2)2
PROF. MASASCHI

Lectures and laboratory instruction in the use of research apparatus in modern textile research techniques. Experiments are designed to include such instruments as the Fisher and the Beckman titrimeters; the Stormer, the Zahn and the Brookfield viscosimeters; the Abbé and the immersion refractometers; the Du Nöuy and the manometric tensiometers; and the Instron Tensile Tester.

CHEM. 528 INSTRUMENTAL METHODS IN TEXTILE RESEARCH (1-2)2
STAFF

Experiments include radioactive tracer element techniques, the electron microscope, the spectrograph, and the X-ray.

CHEM. 531-532 TEXTILE CHEMISTRY SEMINAR (2-0) (2-0)4
PROF. SKINKLE

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

COTTON

COTTON 201-202 COTTON CARDING (3-2) (3-2)8
Prerequisites: ENG. 102 *and* ENG. 112 PROF. POPE
Required in Course I

This is a study of the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing and roving. Considerable time is devoted to the studying of cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. Experiments and studies of the card room machinery are designed to acquaint the student with typical mill equipment and its

use in processing commonly used cottons. The mill processes are studied in detail, through specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

COTTON 211 COTTONS (1-6)3

Prerequisites: COTTON 201 *taken concurrently,* ENG. 102 *and* ENG. 112 PROF. MERRILL

Required in Course I

This subject consists of lectures and laboratory work, supplementary to COTTON 201, for those students who major in cotton manufacturing. The economic importance of cotton is studied, and sources of information regarding cotton and its processing are given to the class. Some time is spent on the details of cotton fiber growth and structure. The commonly measured fiber characteristics are considered with a study of the tests and equipment more commonly used in measuring cotton fiber qualities.

Laboratory time is spent on cotton fiber study work and processing and machinery studies supplementary to, and more detailed than, the work of COTTON 201.

COTTON 222 COTTON WASTE PROCESSING (1-6)3

Prerequisites: COTTON 201 *and* COTTON 202 *taken concurrently.* PROF. MERRILL

Required in Course I

For those specializing in Cotton Manufacture, this subject provides a survey of the methods and machinery used in processing cotton wastes or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment, and the manufacturing processes.

Laboratory work includes the study of ordinary processing wastes, their treatment in preparation for processing, and experiments on machinery used for yarn manufacture by the waste system.

Some of this laboratory time is used to give additional instruction on regular carding, combing, drawing, and roving equipment.

COTTON 231 COTTON YARN MANUFACTURE SURVEY (2-0)2

Open only to students in Course IV MR. KENT

For students with but a secondary interest in Cotton Manufacture, this survey outlines the processes used and the principles of Cotton Yarn Manufacture. The work covers cotton qualities and the production processes of opening, picking, carding, combing, drawing, roving, and spinning.

COTTON 301-302 COTTON SPINNING (2-3) (2-3)6

Prerequisite: COTTON 202 PROF. GOODWIN

Required in Course I

This subject is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning, spooling, winding and twisting machines and their products—plain and fancy yarns, threads, cords and ropes. Particular consideration is given to the production of yarns for different uses and to methods by which desired characteristics may be obtained. All the calculations regarding yarns, spinning frames, spoolers, winders, and twisters are thoroughly studied and problems are assigned for student practice. The laboratory work consists of a series of experiments, synchronized with the lectures, to demonstrate and supplement classroom discussions. In the laboratory, standard industrial machinery is used to process fibers such as are commonly used in cotton mills.

COTTON 311 STAPLE FIBER MANUFACTURE (1-2)1½

Prerequisite: COTTON 301 *taken concurrently* PROF. MERRILL

Required in Course I

With the preparatory subjects as a background, this subject offers a study of the methods of manufacture of various staple fibers, such as wool, rayon, or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the subject is planned to take advantage of the new developments as they appear. A considerable amount of the work in this subject is of the discussion type, which aims to correlate all the work on yarn manufacture and to bring it to bear on the processing of staple fibers.

COTTON 322 COTTON QUALITY CONTROL (1-2)1½

Prerequisites: COTTON 301 *and* 302 *taken concurrently* PROF. MERRILL

Required in Course I

While it is customary to point out defects in the materials during the processing in all the lecture and laboratory work, this subject provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this subject. Every effort is made to develop the diagnostic ability of the student so that he may readily recognize and remedy defects as he meets them.

COTTON 331 or 332 COTTON YARN MANUFACTURE SURVEY (3-1)3

Not open to students in Course I or VI-G MR. KENT

For students with but a secondary interest in cotton manufacture, this survey outlines the processes used and the principles of cotton yarn manufacture. The work considers cotton qualities and production, the processes of opening, picking, carding, combing, drawing, roving, spinning, winding, and twisting.

While this subject consists primarily of lectures, it is planned to include some laboratory demonstrations. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

COTTON 401 MILL ORGANIZATION (4-0)4

Prerequisite: COTTON 302 *or* 304 PROF. MERRILL

This subject correlates all of the work on cotton manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and for the handling of staple fibers are carefully covered. Calculations are made for the machinery necessary to keep plants in balance with some consideration of the best arrangements for economical handling.

COTTON 402 MANAGEMENT PROBLEMS (2-0)2

Prerequisite: COTTON 401 PROF. MERRILL

This subject supplements the one in Mill Organization with some added detail regarding the work in Mill Organization. It includes work on job descriptions, job assignments and work load studies. Some time is spent considering arrangement of machinery for practical routing and operation, auxiliary equipment necessary and materials handling problems for efficient manufacturing.

COTTON 411-412 MAJOR PROJECT Credit to be arranged

Prerequisites: COTTON 302 *and* 322 STAFF

For students majoring in cotton manufacturing, this subject offers an opportunity

to do additional work in some phase of cotton manufacturing for which the student is prepared. Topics to be selected must meet the approval of the head of the department. (This is a type of optional work intended to permit senior students to extend their acquaintance in fields where they have previously built some background. Permission to work in any area must depend upon availability of staff and equipment to meet properly the needs of the students.)

DESIGN

DES. 101 or 102 ELEMENTARY TEXTILE DESIGN (2-1)2
PROF. GOLEC

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves including figured and colored effects; producing chain and draw from the design, and vice versa; and of extending and extracting weaves.

DES. 103 or 104 YARN CALCULATION (1-0)1
PROF. GOLEC

This subject includes relations and determinations of yarn numbers of cotton, woolen, worsted, linen, silk, and synthetic; grading of folded, ply, novelty and fancy yarns.

DES. 122 PERSPECTIVE (0-2)1
PROF. ROSATTO

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye. This aids the student in freehand drawing.

DES. 203-204 TEXTILE DESIGN AND FABRIC ANALYSIS (3-2) (3-2)8
Prerequisites: DES. 102 and 104 PROF. FOX
Open only to students in Course III

In the first semester, consideration is given to cotton fabrics using plain, twill, or sateen constructions, and employing stripe, check, or plaid patterns. In the second semester, fabrics studied are those having extra warp and extra filling figured patterns, together with Bedford cords, velveteens, plushes and corduroy fabrics. In both semesters, the work includes the analysis of the fabrics as well as the necessary calculations required to reproduce them or to construct fabrics of similar character.

DES. 211-212 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6
Prerequisites: DES. 102 *and* 104 MR. GRAY
Open only to students in Course III

In the first semester, instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second semester, instruction is given in the construction of warp and filling backs, double and triple cloths, Chinchillas, and extra warp and filling figures.

DES. 222-223 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4

Prerequisites: DES. 101 *and* 103 PROF. FOX

Required in Courses I, V (222) and VII

Not open to students in Course III

This subject offers work similar but less detailed than the material covered in DESIGN 203-204 and DESIGN 301-302.

DES. 224 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2

Prerequisites: DES. 101 *and* 103 PROF. FOX

Required in Courses VI-E and VI-G

Not open to students in Course III

This is a skeleton course patterned after DES. 222-223.

DES. 232-233 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4

Prerequisites: DES. 101 *and* 103 MR. GRAY

Required in Courses II and VII

Not open to students in Course III

This subject offers work similar to, but less detailed than, the material covered in DESIGN 211-212 *and* DESIGN 311-312.

DES. 234 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2

Prerequisites: DES. 101 *and* 103 MR. GRAY

Required in Courses VI-E and VI-G

Not open to students in Course III

This is a skeleton subject patterned after DESIGN 232-233.

DES. 251-252 COLOR (1-1) (1-1)4

Open to students in Courses III and VII PROF. ROSATTO

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids, and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question.

Because of the work required as a part of the laboratory, extra credit is allowed.

DES. 262 COLOR (1-1)1

Required in Course I PROF. ROSATTO

This subject includes the same general information as DES. 251-252 but in less detail.

DES. 271 COLOR (1-1)1

Required in Course II PROF. ROSATTO

This subject includes the same general information as DES. 262 but deals with blends of colored stock.

DES. 301-302 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisite: DES. 204 PROF. FOX

Open only to students in Course III

In the first semester, synthetic fabrics are analyzed covering design, construction, yarns, both spun and filament, and finished fabric characteristics. Also covered in this semester are cotton ply fabrics including the weave and construction of two-ply, three-ply, and four-ply fabrics together with the analysis of these fabrics in wide woven and narrow woven non-elastic belts and webs. The second semester covers wide and narrow woven elastic webs, piques, and lappet- and swivel-woven fabrics, as well as Mitchelins, loose-and fast-back quilting fabrics, and toilet cloths.

DES. 303 SYNTHETIC FABRIC DESIGN AND ANALYSIS (1-2)2

Prerequisite: DES. 222 *or* 224 PROF. FOX

Required in Course V

This subject covers the comparison and analysis of various synthetic fabrics as to the construction, yarn denier, filament size, and weave, as well as finished fabric characteristics.

DES. 311-312 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisite: DES. 212 MR. GRAY

Open only to students in Course III

This subject includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in cloth construction includes the application of the different weaves and their combinations in the production of fancy designs as well as the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, size of yarn and value. Particular attention is given to the construction of new designs by the use of suggestion sheets as well as to the new fabrics to be constructed upon a base fabric, previously analyzed, in the manner outlined on the suggestion sheets, keeping within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. This subject is restricted to woolen and worsted fabrics, but includes blends with other fibers, as well as filament yarn combinations for fancy effects.

DES. 401 LENO FABRIC DESIGN AND ANALYSIS (1-1)1½

Prerequisite: DES. 302 *or permission of instructor* PROF. FOX

Open only to students in Course III

A complete study is given in leno fabric design, using the modern steel doups and super-doups.

DES. 402 ADVANCED TEXTILE DESIGN AND ANALYSIS (2-1)2

Prerequisites: DES. 312, DES. 401, WEAV. 302 *or permission of instructor* PROF. GOLEC

Open only to students in Course III

The first half of the semester is devoted to the study of Leavers Lace including history, manufacture, finishing, a detailed study of the Leavers machine, and the basic principles of lace design and drafting. The second half of the semester covers a study of embroideries and rugs. Schiffli embroidery includes the Schiffli

machine, basic principles of Schiffli design, manufacturing, finishing and types and end uses of embroidery. Rugs include a study of the principles of construction of the analyses of Chenille, Wilton, Brussel, Tapestry, Velvet, and Axminster carpets.

DES. 411-412 JACQUARD DESIGN AND WEAVING (1-2) (1-2)4
Prerequisites: DES. 204, DES. 242, WEAV. 302 — PROFS. GOLEC AND HOELLRICH
Required in Course III

This subject correlates the instruction in weaving on the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, to choose the proper weave for both the background and foreground, to cut cards and lace, and to weave the fabric.

DES. 413 or 414 JACQUARD DESIGN (0-2)1
Prerequisites: DES. 101 *or* 102 — PROF. GOLEC

This is an elective subject in which the student is taught to transfer a given motif to cross section paper, to choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to enable the student to appreciate the complete operation from the motif to the loom.

DES. 421 or 422 DESIGN AND WEAVING SEMINAR — STAFF
Credits and hours to be arranged
Prerequisite: Major in Course III or by special permission

This subject consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

ECO. 201-202 ECONOMICS (3-0) (3-0)6
Required in Courses I, II, III, IV, V, VI-E, VI-G and VII — PROF. CUSHING

This course is a basic one in the principles and practices of economics. It deals briefly with economic history, showing how the present economic system has evolved from past systems. It shows how the experience of the past can aid in the solution of present problems.

ECO. 311 ECONOMIC STATISTICS (3-0)3
Required in Course VII — PROF. EDLUND

This subject covers the basic concepts of the statistical method with special emphasis on those approaches of most interest to the student of management. Topics covered include: measures of central tendency, graphic methods, dispersion, skewness, sampling, normal curve, index numbers, correlation, time series, secular trend, seasonal variation, business cycle, and statistical forecasting.

ECO. 321-322 PRINCIPLES OF MARKETING (3-0) (3-0)6
Required in Course VII — PROFS. EDLUND AND MANDELL

ECO. 321 is an introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. This subject will cover the history and economic importance and the functions in modern distribution of the selling agent, the

commission man, the broker, jobber, merchant, factor, and other intermediaries. It will also consider the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

Eco. 322 is a continuation of Eco. 321. Some of the topics studied are economic aspects of fashion, branding, sales promotion and advertising, market research, analysis of distribution costs, forecasting, market potentials, price policies, legal aspects of marketing, vertical integration, sales planning and control and the complete campaign.

Eco. 341 ACCOUNTING—I (3-0)3

Prof. Mandell

This is a basic course in accounting. The first portion of the semester will be devoted to a consideration of the economic significance of accounting, the underlying accounting theories, and the organization and use of modern accounting records. Attention will be given to the preparation and interpretation of reports and statements of financial position. The balance sheet, profit and loss statement, theory of debits and credits as applied to journalizing, and the usage of the various ledgers will be covered. Cost accounting methods and systems as applied to industry will be the subject of discussion for the last portion of the semester's work.

Eco. 342 ACCOUNTING—II (3-0)3

Prof. Mandell

This course is designed to further acquaint the student with accounting practice, emphasis here being placed on partnership and corporate records. Special emphasis will be given to payroll and tax accounting in addition to work dealing with installment and branch accounting techniques. The peculiar aspects of manufacturing accounting will be covered in detail, with the application of cost principles to this area.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING (3-0)3

Required in Course VII Prof. Edlund

A comprehensive subject dealing with the fundamental principles of advertising and salesmanship. Topics covered include: psychology of selling and advertising, copy writing, layout, printing and engraving, testing and research, planning an advertising campaign, government restrictions, types of media, radio advertising, trademarks, building a selling talk, fundamentals of salesmanship, types of personal selling, personality, retail salesmanship, training, etc.

Eco. 351 TEXTILE MARKETING (2-0)2

Required in Courses I, II, III, IV, V and VI-G Prof. Edlund

This subject is a condensation of the more important parts of Eco. 321 and 322, of particular interest to those not specializing in distribution. It will survey the marketing channels for textiles, chief intermediaries, fashion, branding, marketing research, vertical integration, and sales promotion.

Eco. 412 INDUSTRIAL MANAGEMENT: PRINCIPLES AND PROBLEMS (3-0)3

Required in Courses I, II, III, V, VI-E, VI-G, VII and IX Profs. Robertson and Mandell

This subject is divided into four general areas: backgrounds of modern industry; organization of the industrial enterprise; the operation of the modern

industry; and coordination of the productive processes. The text material is supplemented with current readings and case material.

Among the topics covered are: Risks, Forecasting, Financing, Product Development, Plant Layout, Production Controls, Personnel Management, Time and Motion Studies, Job Evaluation, and Wage and Salary Administration.

Eco. 421 FOREIGN TRADE (3-0)3

Prerequisite: Eco. 202 PROF. MANDELL

Required in Course VII

This subect will cover the growth and development of foreign trade, international commercial policies, transportation and communication facilities, and international finance. A good portion of the term's work will be devoted to a study of the practical aspects of exporting and importing. Examples will be given in the textile field wherever possible and actual documents relating to foreign trade will be exhibited and used in rgular class work.

Eco. 431-432 SELLING POLICIES (3-0) (3-0)6

Prerequisite: Eco. 322 PROF. EDLUND

Required in Course VII

This subject will cover the development of administrative policy and guiding principles in the marketing, pricing, styling, and merchandising of textile products. Topics covered include: sales supervision and control, credit policies, inventory control, standardization and simplification, the sales contract, arbitration, trade associations, principles of wholesaling and retailing, and use of cost accounting in distribution.

The second term is conducted by the seminar method and includes discussions and reports on business cases involving all phases of management and distribution policy.

Eco. 468 FINANCIAL MANAGEMENT (2-0)2

PROF. MANDELL

This subject will cover the organization and financing of private enterprise, partnership, trust, and corporate types of business establishments. A portion of the semester's work will be devoted to a study of the stock and bond markets. Emphasis will be placed on the study of the corporation in formation, operation, dissolution, and reorganization.

ENGINEERING

ENG. 102 MECHANISM (4-0)4

Required in Courses I, II, V, VI-E VI-G and VII PROF. THOMAS

This course is a study of the basic principles of kinematics, in which the wide variety of process machinery available furnishes many specific examples. Frequent use of these mechanisms is made in the development of the subject. Some of the important topics covered are the following: rolling cylinders and cones, gearing, gear train design, epicyclic gear trains, flexible connectors including stepped pulley and cone design, cam design, linkages, and miscellaneous mechanisms.

ENG. 104 MECHANISM (2-0)2

Required in Courses III, IV, VIII and IX PROF. THOMAS

Not open to students in Courses VI-E and VI-G

This subject is an abbreviation of ENG. 102, and is designed for those students not majoring in engineering.

ENG. 111 ENGINEERING DRAWING (0-6)2

Required in all courses PROFS. GELINAS AND AINSWORTH
MR. ROGERS

This subject consists of both freehand and mechanical drawing and covers the following items: lettering, geometric construction, orthographic projection, isometric and cabinet drawing, and dimensions.

ENG. 112 ENGINEERING DRAWING (0-6)2

Required in Courses I, VI-E VI-G VIII and IX PROF. GELINAS,
MR. ROGERS

A continuation of ENG. 111 which includes the following topics: auxiliary views, cross sections, advanced dimensioning, sketching of machine parts, working drawings, tracing and blueprinting, intersections, and developments.

ENG. 114 ENGINEERING DRAWING (0-3)1

Required in Courses II, III, V and VII PROF. GELINAS

A continuation of ENG. 111 and abbreviation of ENG. 112.

ENG. 122 MACHINE TOOL LABORATORY (1-2)1

Required in courses I, II, V, VI-E, VI-G VII and VIII PROFS. BELL
AINSWORTH
AND STAFF

The objective of this subject is to give the student an insight into the processing of metals through lectures and practical laboratory applications covering the basic machine tools such as the lathe, shaper, drill-press, and milling machine, and also the uses of measuring instruments, threads, and gears. Lectures and demonstrations cover topics such as pattern work, foundry practice, die-casting, welding, and forging.

ENG. 201 MACHINE DRAWING (0-3)1

Prerequisite: ENG. 112 PROF. GELINAS

Required in Courses VI-E and IX

This subject is made up of several short problems involving centers of gravity, counterweights, cam layouts, piping, welding, sheetmetal drafting, and assembly drawings.

ENG. 212 HEAT AND POWER (2-2)3

Prerequisite: PHYS. 201 PROF. WELLS

Required in Course II

Not open to students in Course VI-E or VI-G

This subject is similar to ENG. 311 but is briefer and is designed for those not majoring in engineering.

ENG. 221 TEXTILE MECHANISM (1-2)1½

Prerequisites: ENG. 102 *and* ENG. 112 PROF. HINDLE

Required in Course VI-E

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

ENG. 222 APPLIED MECHANICS (3-0)3
Prerequisites: Math. 201 *and* PHYS. 101 STAFF
Required in Courses VI-E and IX

This subject covers the fundamentals of statistics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

ENG. 233 MACHINE TOOL LABORATORY (0-3)1
Required in Course VI-E PROFS. BELL AND AINSWORTH

This subject is a continuation of ENG. 122, giving practical and more detailed instruction in such operations as lay-outs, filing, drilling, planing and shaping, and places special emphasis on precision work.

ENG. 301-302 ADVANCED APPLIED MECHANICS (3-0) (3-0)6
Prerequisites: ENG. 222 *and* MATH. 202 PROF. HINDLE
Required in Course VI-E

This subject covers the general topic of strength of materials and includes such topics as simple stresses, strain, bending moments, hearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, reversals of stress, impact stresses, vibrations, and stress analysis by strain gage methods.

ENG. 311 PRINCIPLES OF HEAT ENGINEERING (3-2)4
Prerequisites: ENG. 102, MATH. 202 *and* PHYS. 201 PROF. WELLS
Required in Course VI-G

The basic principles of thermodynamics, properties of steam and its utilization in manufacturing processes, and the combustion of fuels are considered in this subject.

A brief treatment of steam engines, turbines and pumps is also included. Special consideration is given to the use of steam in textile mills.

ENG. 312 HEAT ENGINEERING (3-2)4
Prerequisites: MATH. 202 *and* PHYS. 201 PROF. WELLS
Required in Course VI-E

The purpose of this subject is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures, and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS (3-0)3
Prerequisites: MATH. 201 *and* PHYS. 101 STAFF
Required in Courses VI-G and IX

A more elementary and condensed treatment of ENG. 301-302.

ENG. 331 MILL ENGINEERING (3-0)3
Prerequisite: ENG. 222 PROF. HINDLE
Required in Course VI-E

This subject consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construc-

tion from a study of actual blueprints, calculation of allowable floor loads, stresses in beams and columns, machinery layout and the use of the transit in elementary surveying.

ENG. 332 ENGINEERING MATERIALS (2-0)2

Prerequisite: PHYS. 202 PROF. HINDLE

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treament; also the properties and use of non-metallic engineering materials such as timber, cement, concrete, rubber, plastic, and mechanical fabrics.

ENG. 342 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4

Prerequisite: PHYS. 321 PROF. HORTON BROWN

Required in Courses VI-E and VIII

At the beginning of this subject polyphase circuits are considered. The greater part of the subject, however, is devoted to direct-current generators and motors with a study of their construction and characteristics. The accompanying laboratory work illustrates the various methods of measuring polyphase power and of determining the characteristics of direct-current generators and motors. To be followed by ENG. 401.

ENG. 344 ELECTRICAL MACHINERY (3-2)4

Prerequisite: PHYS. 321 PROF. HORTON BROWN

Required in Courses VI-G and IX

This subject is a condensation of ENG. 342 *and* ENG. 401.

ENG. 351 EXPERIMENTAL APPLICATIONS OF STATISTICS (3-0)3

Prerequisite: MATH. 201 *or* 203 PROF. BALL

Required in Courses VI-E, VIII and IX

The subject deals with those fundamental statistical measures which are required for the analysis of experimental data, and with the practical applications of statistical analysis to quality control and to the planning of industrial experiments.

ENG. 401 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4

Prerequisite: ENG. 342 PROF. HORTON BROWN

Required in Courses VI-E and VIII

This is the second semester of work in the electrical field having been preceded by ENG. 342 in the junior year.

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method is compared with a laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn, and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for the motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

ENG. 402 TEXTILE APPLICATIONS OF ELECTRICITY (1-4)1

Prerequisite: ENG. 344 *or* 401 PROF. HORTON BROWN

Required in Courses VI-E and VI-G

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. Trips are made to local mills to see the equipment in actual operation.

ENG. 411 ADVANVED HEAT ENGINEERING (2-2)3

Prerequisit: ENG. 312 PROF. WELLS

Required in Course VI-E

The topics developed in the lectures and amplified in the laboratory are the Kinematics of stationary steam generating units, reciprocating engines, steam turbines, pumps, condensers, and internal combustion engines.

ENG. 422 TEXTILE PROCESS INSTRUMENTATION (2-0)2

Prerequisite: PHYS. 202 PROF. THOMAS

Required in Courses VI-E and VI-G

This subject is divided into three parts. First, a study is made of the indicating and recording instruments used to measure such common textile process variables as pressure, temperature, humidity, liquid level, fluid flow, etc.

The second part covers an analysis of the mechanisms (pneumatic and electric) which are used to control these variables and includes a detailed discussion of the final control elements, such as valves and motor levers, which are associated with the controller mechanisms.

Finally, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, and finishing are studied from data obtained from actual mill installations.

ENG. 424 MACHINE DESIGN (2-2)3

Prerequisitess ENG. 221, 233 *and* 302 PROF. HINDLE

Required in Course IX

This subject covers the design of machine elements, such as fasteners, shafts, frames, bearings, gears, clutches, springs keys and drives. Data for most of the problems are taken from actual machines in the various laboratories.

ENG. 425-426 ENGINEERING DESIGN OF TEXTILE STRUCTURES (2-0) (2-0)4

Prerequisites: ENG. 321 MATH. 202 *and* PHYS. 202 PROF. BALL

Required in Course VI-E

This subject correlates engineering properties of textile materials, engineering principles, and textile processing in the design of textile structure with designed properties. The subject matter is presented in two major divisions. The first deals with the geometry of yarns and fabrics, and the extent to which it is possible to design the dimensions of a textile structure for a certain functional use or to predict the dimensional changes which will occur during such use. The second division deals with the design from the standpoint of the stresses, strains, and energy changes which the end-use imposes, and is based upon the information supplied by analyses of load-elongation diagrams for one-time and for repeated loadings of the textile structural material.

ENG. 431 ADVANCED PHYSICAL TESTING (1-3)2

Prerequisite: TEX. 312 PROFS. BALL AND THOMAS

This subject provides a more detailed analysis of the textile testing methods currently utilized in the industry, both in quality control and in research, extending the laboratory work to cover a wider variety of equipment than is studied in TEX. 311-312.

ENG. 502 STATISTICAL QUALITY CONTROL (3-0)3

Prerequisite: ENG. 351 STAFF

This subject includes a study of the various types of control charts for maintaining quality of manufactured products and of the several types of sampling plans for the reduced inspection of manufactured products and of raw materials. Applications of the foregoing statistical techniques to industry in general are discussed, with special emphasis on their application to the textile and other industries.

ENG. 505-506 METHODS OF EXPERIMENTAL STRESS ANALYSIS (3-1)3½

Prerequisites: MATH. 202, PHYS. 202, ENG. 302 PROF. KATZ

An introduction to some of the experimental techniques used in stress analysis. Photoelesticity, electrical strain gages, brittle coating, and mechanical gages are considered in relation to the analysis of both static and dynamic stresses. Special attention is given to the application of these techniques in the study of textile structures and machinery.

ENGLISH AND HUMANITIES

ENGL. 101-102 ENGLISH COMPOSITION AND LITERATURE (3-0) (3-0)6

Required of all freshmen PROFS. DOW, RILEY AND STEARNS

This course is a basic one in rhetoric and composition, relating specifically to the four forms of discourse—description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

ENGL. 201 or 102 SPEECH (2-0)2

Prerequisite: ENGL. 102 PROF. DOW

Required in all courses

The aim of this subject is to achieve effective delivery of various types of speech. All kinds of delivery—extemporaneous, impromptu, memorized — and the like are studied and analyzed.

ENGL. 211 or 212 BUSINESS ENGLISH (1-0)1

Prerequisite: ENGL. 102 PROF. DOW

Required in all courses

Analysis and practice in letter writing, a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity are the objectives of this course.

ENGL. 222 APPRECIATION OF LITERATURE (3-0)3

Prerequisite: ENGL. 102 PROF. DOW

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

FIN. 401-402 WOOLEN AND WORSTED FINISHING (2-3) (2-3)6
Prerequisite: CHEM. 102 — PROF. NOWELL
Required in Course II

This subject is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbing, brushing, shearing, and pressing.

FIN. 411 or 412 WOOLEN AND WORSTED FINISHING (3-3)4
Prerequisite: CHEM 102 *or* 104 — PROF. NOWELL
Not open to students in Course II

This subject is a similar but abbreviated version of FIN. 401-402, designed for students not majoring in wool manufacture.

FIN. 421-422 COTTON AND SYNTHETIC FINISHING (2-3) (2-3)6
Prerequisites: CHEM. 222 *and* TEX. 302 — PROF. MCDONALD
Required in Course I — MR. PEIRENT

All the major physical and chemical operations necessary for the conversion into the finished state of staple gray cotton and synthetic fabrics are considered. In addition to inspection, singeing, desizing, padding, drying, calendering, curing, etc., the preliminary wet processing operations through dyeing are illustrated. Among the types of finishes employed are those of starching, softening, repelling, stabilizing, decating, etc., as well as the thermo-plastic and thermo-setting resins; the physical, rather than the chemical, aspects are stressed.

FIN. 431 COTTON AND SYNTHETIC FINISHING (3-0)4
Prerequisite: TEX. 302 — PROF. MCDONALD
Required in Courses III, VI-E, VI-G and VII — MR. PEIRENT

This is similar to FIN. 421-422 but is an abbreviated version thereof, with emphasis upon the mechanism of conversion.

FIN. 432 COTTON AND SYNTHETIC FINISHING (3-3)4
Prerequisites: CHEM. 202, TEX. 302 — PROF. MCDONALD
Required in Courses IV and V — MR. PEIRENT

This is a somewhat abbreviated version of FIN. 421-422 with chemical, rather than physical, aspects predominant.

KNITTING

KNIT. 401 KNITTING (2-5)4
Prerequisites: DES. 223 *or* 233 *or* 234; ENG. 102 *and* ENG. 112 — PROF. JONES

This subject is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics

from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The production, design, and analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

KNIT. 403 or 404 KNITTING (2-3)3
Prerequisites: DES. 103; ENG. 102 *and* ENG. 112 PROF. JONES

This subject is similar to KNIT. 401, but requires less laboratory time.

KNIT. 412 ADVANCED KNITTING (2-5)4
Prerequisite: KNIT. 401 PROF. JONES

This is an advanced subject for students who are specializing in knitting. With the approval of the department head, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

GERMAN. 201-202 TECHNICAL GERMAN (3-0) (3-0)6
Required in Course IX PROF. CUSHING

This course is an introductory one in the basic elements of German, leading to a working knowledge of technical German. This subject is aimed primarily at developing a reading ability in scientific German.

GERMAN. 301-302 ADVANCED TECHNICAL GERMAN (3-0) (3-0)6
Prerequisite: GERMAN 202 *or equivalent* PROF CUSHING
GERMAN 301 *may be taken without continuing* GERMAN 302

This course is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

LEATHER

LEA. 202 APPLIED LEATHER ANALYSIS (1-6)3
Prerequisite: CHEM. 213 PROF. CHOUINARD
Required in Course IX

A subject designed to acquaint the student with the accepted methods of analysis of the American Leather Chemists Association and other supplementary procedures.

LEA. 301-302 LEATHER MANUFACTURE (3-6) (3-6)10
Required in Course IX PROF. CHOUINARD

This is the student's introduction to the general technology of leather manufacture. The first semester is devoted to examining government regulations in imported hides and skins, studying the purchasing of hides and skins, and classifying various hide damages. This is followed by work on the handling of raw stock at the tannery, unhairing, bating, and hide classification. The second semester is concerned primarily with the study of vegetable tanning, chrome tanning, and various other types of tanning. In the work throughout the year

the material covered in lectures is supplemented by laboratory studies on a small scale.

LEA. 303 HISTO-PATHOLOGY OF ANIMAL TISSUES (1-6)3
Prerequisite: CHEM. 201-202 STAFF
Required in Course IX

The histological study of animal hide as regards cell reproduction, glands and thermostat mechanism growth of hide fibers, elastin, nerve and grain patterns,

LEA. 304 MICROSCOPY IN TANNING (1-3)2
Prerequisite: LEA. 303 STAFF
Required in Course IX

This subject is designed to educate the student in the use of a microscope as an aid in the study of hides and leathers under various conditions. The technique of using normal, fluorescent and polarized light is taught as well as the application of staining with some emphasis on photomicrograph.

LEA. 322 TANNING MECHANISMS (3-0)3
Prerequisite: CHEM. 201-202 PROF. CHOUINARD
Required in Course IX

The general study of the various concepts applied to the understanding of what constitutes tanning, both practical and theoretical. This will involve a study of the raw materials as well as the finished product.

LEA. 401-402 LEATHER MANUFACTURE (3-6) (3-6)10
Prerequisite: LEA. 302 PROF. CHOUINARD
Required in Course IX

A continuation of the study into the technology of leather manufacture covering the various currying treatments applied to rough leather such as fat liquoring, stuffing, dyeing and the various mechanical operations of setting, stretching, etc. It is intended to show how widely the physical properties of leather may be varied and controlled by the proper application and selection of these numerous operations and treatments.

LEA. 404 PROPERTIES OF LEATHER (2-3)3
Prerequisites: ENG. 351 *and* LEA. 401 STAFF
Required in Course IX

A practical and theoretical study of the charactesistics of leather in relation to the end use. Studies will be made on measuring and classifying the effect of changes in manufacturing procedure, both chemical and physical. Leather, because it is a natural product, varies considerably within the same hide. Thus, the nature of this variation is very important and the study of any changes affecting it are, in turn, important.

LEA. 411-412 LEATHER PROBLEMS (1-6) (1-6)6
Prerequisite: LEA. 302 PROF. CHOUINARD
Required in Course IX

This subject is designed primarily to enable the student to put into practical application the various scientific principles of physics, chemistry, mathematics, economics, etc. on problems of an industrial nature. This may encompass anything from the design and layout of any of a number of special leather plants to the suggested solution of practical problems which arise in the operation of a modern leather business.

MATHEMATICS

MATH. 103-104 COLLEGE MATHEMATICS (3-0) (3-0)6

Required of all freshmen PROF. HARRY BROWN AND STAFF

The work in the first term consists of algebra and plane trigonometry. Algebra is reviewed through quadratics; and then logarithms, simultaneous equations, and theory of equations are studied. In plane trigonometry, the solution of right and oblique triangles is reviewed and identities and equations are taken up. Instruction in the use of the slide rule is given and the use of approximate data is discussed.

In the second term, the following topics are considered: the straight line, equations of various curves, differentiation of algebraic functions.

MATH. 201-202 ANALYTIC GEOMETRY AND CALCULUS (4-0) (4-0)8

Prerequisite: MATH. 104 PROF. HARRY BROWN

Required in Courses VI-E, VI-G and IX AND STAFF

In the first term the following topics are treated: Maximum and minimum values, rates and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, and applications of integration. In the second term the topics treated are differentiation of transcendental functions, methods of integration, solid analytic geometry, polar coordinates, partial differentiation, and empirical formulas.

MATH. 203-204 MATHEMATICS FOR CHEMISTS (4-0) (4-0)8

PROF. OUELLETTE

Prerequisite: MATH. 104 MR. DEVEJIAN

Required in Courses IV and VIII MR. HUMISTON

This subject is a continuation of MATH. 103-104. The first term consists of analytic geometry and calculus including the following topics: maximum and minimum values, rates and differentials, the conic sections, indefinite integrals, summation by integration, areas, volumes, pressures.

The second term includes exponential, logarithmic, and trigonometric functions; measurements and computation rules; properties of logarithmic equations; triangular graphs; semi-logarithmic and logarithmic graphs; exponential growth and decay; curve fitting; chemical applications of differential equations; and partial derivatives.

MATH. 211-212 MATHEMATICS (3-0) (3-0)6

Prerequisite: MATH. 104 MR. DEVEJIAN

Required in Courses I, II, III, V and VII MR. HUMISTON

The first term of this subject taken by students not majoring in chemistry or engineering, deals with applications of differentiation, analytic geometry of the conic sections, and integration of algebraic functions.

In the second term, applications of integration, construction of nomographic charts, and the derivation of empirical equations are considered.

MATH. 402 DIFFERENTIAL EQUATIONS (3-0)3

Prerequisite: MATH. 202 *or* 204 PROF. OUELLETTE

The following topics are treated: a review of series and partial differentiation, first- and second-order differential equations, and first- and second-order partial differential equations. The practical applications illustrated are designed for the chemist and the engineer.

PAPER

PAPER 201-202 PULP AND PAPER MANUFACTURE (3-0) (3-0)6
Prerequisite: CHEM. 102 PROF. LEWIS
Required in Course VIII

Lectures on the production and technology of pulp and paper.

PAPER 302 PULP AND PAPER MANUFACTURE (3-0)3
Prerequisite: PAPER 202 PROF. LEWIS
Required in Course VIII

This is a continuation of the earlier subject.

PAPER 303 WOOD TECHNOLOGY (3-3)4
Required in Course VIII STAFF

This comprises an elementary study of the principal woods used in pulping, their occurrence and principal characteristics. This lecture work is accompanied by training in microscopy leading eventually to fiber analysis of a finished paper.

PAPER 312 PULP AND PAPER TESTING AND ANALYSIS (4-7)6
Prerequisites: CHEM. 213 *and* PAPER 202 STAFF
Required in Course VIII

A series of lectures and laboratory periods designed to give a thorough knowledge of the testing methods and analyses carried out in the industry. Particular attention will be paid to the theory and principles of the test methods employed.

PAPER 401 PRACTICE WORK IN INDUSTRY 18 CREDITS
Prerequisite: PAPER 302 STAFF
Required in Course VIII

In order to give the student as thorough a knowledge of industrial problems and practices as possible, it is planned, in cooperation with several mills and converting plants, to set up practice stations. The students will spend several weeks at each of these stations working on technical problems of interest to the mill management, but under the supervision of a member of the Institute staff.

PAPER 403 MATERIALS OF CONSTRUCTION, CORROSION 2 CREDITS
Prerequisite: PAPER 401 *taken concurrently* STAFF
Required in Course VIII

This subject, given at the Practice Stations, covers the common construction materials used in the industry and their ability to stand up under various conditions of use. It will be illustrated by examples in the plants studied.

PAPER 404 PAPER COATING AND CONVERTING (3-0)3
Prerequisite: PAPER 302 STAFF
Required in Course VIII

This subject covers the principal operation of the converting industry. Coating, treating and impregnating, laminating, embossing, and creping will be treated and, if time permits, printing.

PAPER 412 INDUSTRIAL CELLULOSE CHEMISTRY (1-0)1
Prerequisite: CHEM. 202 PROF. LEWIS
Required in Course VIII

The manufacture and use of the chief cellulose derivatives will be reviewed. In addition, various chemical treatments for cellulose in the paper and textile fields will be discussed.

Paper 414 ADVANCED PAPER PROBLEMS (2-6)4
Prerequisite: Paper 401 Staff
Required in Course VIII

This is designed to give the senior an opportunity to work upon a problem connected with some phase of the paper or paper converting industry. Problems will be selected by the student and staff in collaboration.

PHYSICAL EDUCATION

(2-0)0
Prof. Cushing
Messrs. Morey and Yarnell

All members of the Freshman Class are required to take a course in physical training conducted under the direction of an instructor in physical education. It is planned to help each student meet reasonable standards of physical fitness, and through regularity and continuity of physical exercise, to maintain good physical condition. The men are taught basic skills in several team sports. Students on athletic squads are not required to attend these classes during the season they are actively engaged in that sport.

PHYSICS

Phys. 101 PHYSICS (4-1)4½
Required of all freshmen Prof. Thomas and Staff

This subject covers the basic principles of mechanics which are absolutely essential to more advanced studies in any scientific field. Some of the important topics covered are vector analysis, equilibrium of concurrent forces, equilibrium of non-current forces, rectilinear and curvilinear motion, inertia, harmonic motion, moment of inertia, conservation of energy, simple machines, hydrostatics and elements of hydraulics.

Phys. 201-202 PHYSICS (3-2) (3-2)8
Prerequisite: Phys. 101 Prof. Harry Brown
Required in all courses Mr. Hall

This is a continuation of Phys. 101 and is a basic subject relating to the laws and principles of physics and their application. The topics taken up the first term are wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatistics, fundamental laws of direct current and electrolysis, electronics, and elements of nuclear physics.

Phys. 321 ELECTRONICS VI-E (3-2)4
Prerequisite: Phys. 202 Others (3-1)3½
Required in Courses VI-E, VI-G VIII and IX Prof. Horton Brown

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. The elements of vacuum and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation are discussed as well as industrial photoelectric relays, time delay relays, and Thymotrol motor controls.

PHYS. 401 TEXTILE MICROSCOPY (1-3)2

Prerequisites: PHYS. 202 *and* TEX. 312 — PROF. HARRY BROWN

Applications of the microscope to textile materials are emphasized in this subject. It includes methods of sectioning, measurement of cotton immaturity and mercerization, determination of denier of rayon, wool grading, fiber identification, quantitive analysis of fiber mixtures and their practical applications. Some of the more advanced aspects of critical microscopy which are essential for the best visual work and photographic practice are considered. Some time is devoted to photographic work and the use of polarized light.

PHYS. 402 TEXTILE PHYSICS (2-3)3

Prerequisites: MATH. 202, PHYS. 202, TEX. 312 — PROF. HARRY BROWN

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The topics taken up include heat transmission of textile materials; color measurements; calculation of tristimulus values; transformaticn to dominant wave-length, colorimetric purity and brightness; measurement of refractive index of fibers; applications of phase microscopy; fluorescent microscopy; use of X-ray diffraction methods to determine crystal orientation and structure of fibers; spectographic analysis; investigation of mineral elements in textile fibers; accurate methods of measuring stress, strain, viscosity, etc.

PHYS. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT

PROF. HARRY BROWN

Credit and hours to be arranged

Prerequisites: MATH. 202 or 204 *and* PHYS. 202

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectaphotometers.

PHYS. 503-504 SPECTROGRAPHIC METHODS (1-3)2

Prerequisite: PHYS. 202 — PROF. KATZ

Applications of the spectograph for the qualitative and quantitative analysis of materials. Special attention is placed on the analysis of trace elements in textile materials and chemicals. Problems are assigned to the students and work is carried out under the supervision of the instructor.

SOCIAL SCIENCES

S.SCI. 101-102 WORLD ECONOMIC GEOGRAPHY (2-0) (2-0)4

MR. MOREY

Through a study of this subject the student gains an appreciation of the economic status of the different geographic areas of the world. It has been shown that the climate, the geographic structure, and the distribution of important raw materials have an effect upon the activities of the people inhabiting those areas and thus, on the types of industry which support the economic life of the various

regions. Since the economic status of a geographic area contributes to the political stability of its people, a study of this subject should help the student to understand the present conflict in idealogies.

S.Sci. 212 WORLD HISTORY SINCE 1900 (3-0)3
PROF. CUSHING

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situation during the war years, 1914 to 1918; and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of the course content will concern the two-decade intermission, 1919-1939, with attention to such factors as the rise of new states; the origin and development of new concepts of nationalism, racism, and other phenomena; and the final alignment of world powers for World War II. The emphasis in the latter part of the subject will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

S.Sci. 221 ECONOMIC HISTORY; THE UNITED STATES (3-0)3
Required in Courses V and VIII PROF. ROBERTSON

This subject offers a study of the foreign and American backgrounds of the economic development of the United States since 1800. Special emphasis is placed upon the Industrial Revolution in America prior to the Civil War and upon the growing international economic importance of American manufacturing and trade during the period.

The major emphasis is upon the post-Civil War development of transportation, finance, manufacturing, and commerce and on the influence of these and other factors in the rise of corporate ownership and mass production and in the development of our present-day machine economy. Particular attention will be given to the economic influences of the two World Wars and to the post-war trends in general business conditions and their effects upon the national economy.

Soc. Sci. 222 MAN AND HIS ENVIRONMENT (3-0)3
Required in Course VII PROF. STEARNS

This subject considers the biological aspects of fundamental problems of heredity and environment which confront man in his economic, social, and cultural life. Emphasis is given particularly to the fields of ecology, genetics and eugenics, evolution, and anthropology.

Soc. Sci. 223 or 224 THE UNITED STATES SINCE 1865 (3-0)3
When requested by a sufficient number of students PROF. MACLAUGHLIN

This course will provide a survey of the advancement of the American people from the Reconstruction Era through World War II. The agrarian problem, rise of big business, expansion of America into a world power, World War I, and the depression are some of the topics that will be discussed from the political, social, and economic viewpoint.

Soc. Sci. 231 or 232 JOURNALISM (3-0)3
Prerequisites: ENGL. 101 *and* ENGL. 102. PROF. RILEY
When requisted by a sufficient number of students

The topics covered in this subject have been included in order that the student

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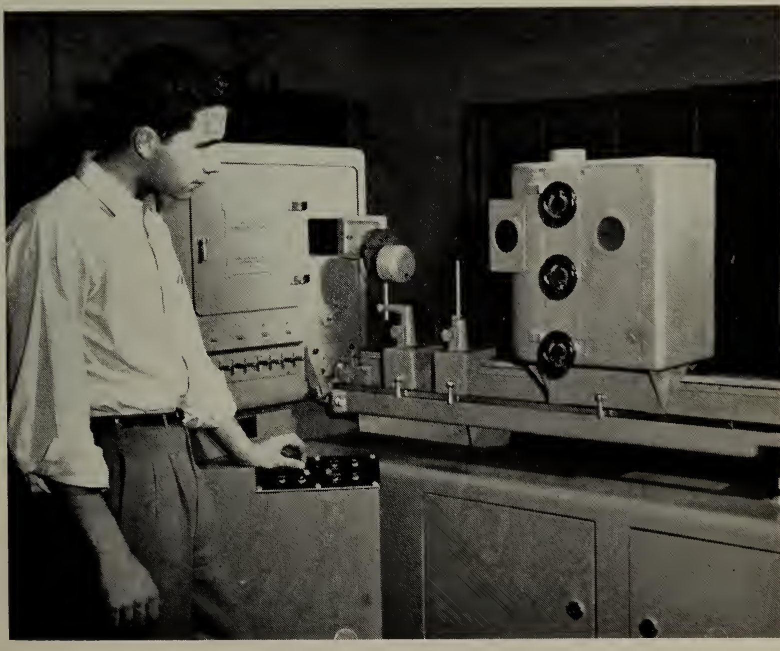
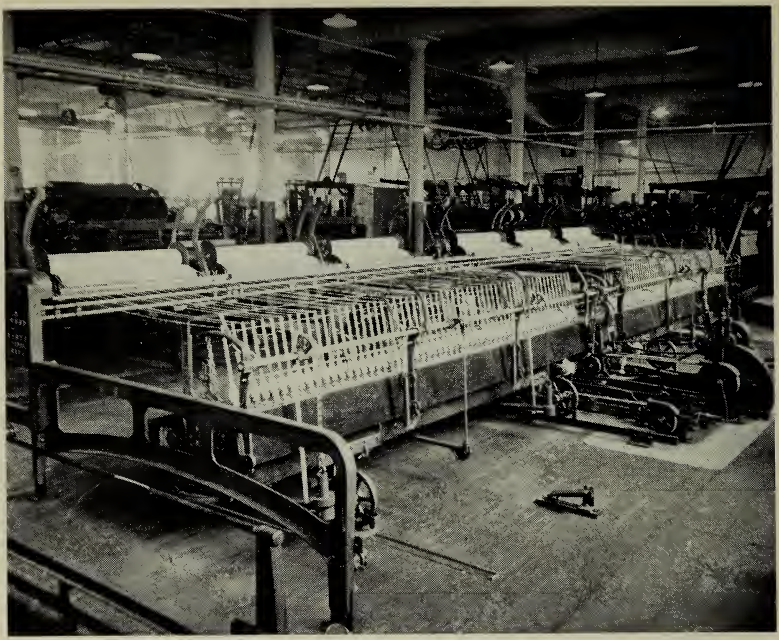
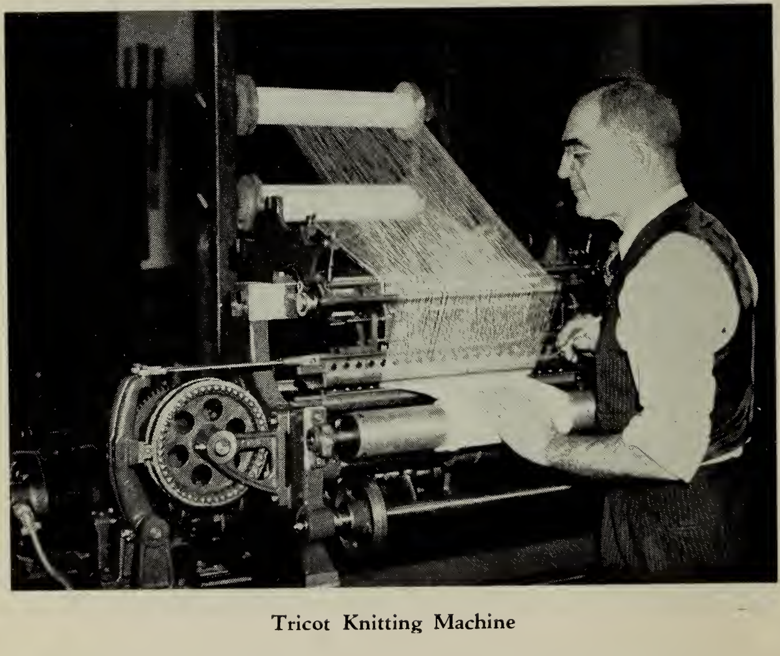
Research with Radio Active Material



Research Using Spectograph



Woolen and Worsted Laboratory



Tricot Knitting Machine

may become able to write facilely, clearly, and fully on an adult level. Forms and structure in general news writing, editorial writing, and feature, business, and science reporting will be taught as well as the elements of newspaper photography. Also covered will be news sources, duties and responsibilities, and libel laws. The latter part of the course will include practice in, and observation of, newspaper makeup and assembly. Visits will be made to printing plants and newspaper establishments to study printing methods, forms, and measurements. Lectures by specialists in various phases of newspaper work will be an integral part of the course.

Soc. Sci. 301 MODERN ECONOMIC PROBLEMS (3-0)3

Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and IX — Prof. Robertson

An intensive study of current developments in the American economy, with emphasis in such fields as security, welfare, labor unionism, labor economics, ownership and management of industry, and trends in government regulation. Lectures, selected readings, and case material will be utilized.

Soc. Sci. 302 MODERN LABOR PROBLEMS (3-0)3

Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and VIII — Prof. Robertson

The subject will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the term, the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of this study will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techniques of the bargaining table and the problems in drafting, interpreting, and administering the modern labor contract.

Soc. Sci. 311 PSYCHOLOGY (3-0)3

Required in Course VII — Prof. Edlund

The subject introduces the student to the place of psychology in the life of the individual and society and seeks to increase the student's understanding of man's mental and emotional processes. The subject matter deals with physiological bases of behavior and experience, attention, perception, memory, thinking, emotions, intelligence, and personality in terms of the whole person in his social setting.

Soc. Sci. 314 PHILOSOPHY OF SCIENCE (3-0)3

Prof. Edlund

This course analyzes the methods and techniques of inductive and deductive science. Elementary logic is studied and applied to the necessary structure of scientific systems. The great concepts and generalizations which have marked the history of science are reviewed and analyzed, as well as the interrelation of science and general philosophy.

Soc. Sci. 321 or 322 COMPARATIVE MODERN GOVERNMENTS (3-0)3

When requested by a sufficient number of students — Prof. Robertson

This course includes a study of the general backgrounds and modern twentieth century development of government in the United States, the English Commonwealth, and the totalitarian nations. Particular attention is given to the chang-

ing roles of the executive and legislative agencies and their increasing intervention in, and influence upon, business.

Soc. Sci. 331 or 322 MUSIC APPRECIATION (3-0)3

When requested by a sufficient number of students. Profs. Katz and Mandell

A survey of music beginning with Beethoven and continuing through modern American composers such as Copland and Piston. Designed to acquaint the student having little or no music background with the composers of the 19th and 20th centuries and their music and styles. The basic purpose of the course is to cultivate a better understanding of music and thereby add to the listening enjoyment of classical and contemporary music. Lecture material will be supplemented by demonstrations and outside listening assignments.

Soc. Sci. 401 or 402 INDUSTRIAL RELATIONS SEMINAR (2-0)2

Prerequisite: Permission of Instructor Prof. Robertson

Required in Course V

This subject will give a small, selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial relations. Case material and hypothetical problems in modern labor management will provide the basis for the study by the group.

Soc. Sci. 461 PERSONNEL MANAGEMENT (3-0)3

Prof. Robertson

This subject involves a comprehensive study of modern labor management techniques in the recruiting, selection, training, and placement of members of the work force. Major emphasis is placed upon the development and maintenance of personnel administration agencies and procedures with the framework of present-day American industry, with special attention to such matters as employee health and safety, welfare and recreation programs, wage and salary administration, training and education, and management relations with labor organizations.

In addition to text material and selected readings, problems will be drawn from actual cases for study and solution by the students. Every effort will be made to acquaint the class with current personnel administration practices in industrial organizations of various types, and to give an appreciation of the importance and magnitude of the labor management function.

Soc. Sci. 463 BUSINESS LAW (3-0)3

Required in Course IX Prof. Robertson

This subject will cover the basic principles of commercial law. Topics studied include: contracts, agency, sales, partnerships, corporation, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guarantee, and bankruptcy.

Soc. Sci. 465 or 466 MANAGEMENT PROBLEMS (3-0)3

Prerequisite: Permission of Instructor Staff

A research course for graduate students and selected seniors. Working under the guidance of the instructor, a student investigates an approved topic in the fields of finance, production, or distribution. The findings of the student are presented in formal thesis form. These theses will then be placed in the department library for permanent record.

Syn. 301 FILAMENT YARN PROCESSING (2-0)2

Required in Course V Prof. Frederick

This subject deals with the processing of natural and made-man continuous

filament fibers from the time they are made available to the textile industry by the manufacturer until they are ready for processing in fabric forms. The nomenclature, purposes, means of accomplishment, and results obtained in the various operations of soaking, winding, throwing, twist setting, coning, and single end sizing are covered in the lectures.

SYN. 302 THROWING PLANT ORGANIZATION (2-0)2
Prerequisite: SYN. 301 — PROF. FREDERICK AND MR. PFISTER
Required in Course V

This subject is essentially a continuation of SYN. 301, with the emphasis being placed upon actual plant organization, processing procedures, and quality control. Plant layouts from machinery viewpoints are discussed and assigned for study. Field trips to local plants are an integrated part of the class work.

SYN. 311 MANUFACTURE OF SYNTHETIC FIBERS (3-0)3
Prerequisite: CHEM. 202 — PROF. HARRIS
Required in Course V

This subject covers the manufacture of man-made fibers. The rayon, estron, polyamide, polyester, vinyl, protein, mineral and metallic fibers are considered from the standpoint of their manufacturing and economic aspects. The subject is approached with the view of presenting the types of processes and the chemistry (reactions and structures) involved in the manipulation of natural high polymers and the synthesis and manipulation of synthetic high polymers into useful textile fibers.

SYN. 312 STRUCTURE AND PROPERTIES OF SYNTHETIC FIBERS (3-0)3
Prerequisites: CHEM. 202 *and* PHYS. 202 — PROF. HARRIS
Required in Course V

In this subject, a study is made of the fundamental structure and properties of the manufactured fibers. The material is developed with the aim to relate the structures of the fibers to their properties and to lay the foundation for the more advanced work covered in SYN. 411-412.

SYN. 322 FILAMENT YARN PROCESSING SURVEY (2-0)1½
Not open to students in Course V — PROF. FREDERICK

This survey is divided into two phases, one pertaining to a brief review of the essential methods involved in the manufacture of man-made fibers, including also their basic physical and chemical properties, and the other pertaining to the handling of natural and synthetic fibers in filament form by a throwster for subsequent utilization by a weaving or knitting plant. Some of the lecture time is devoted to laboratory demonstration, and outside assignments constitute a regular part of the subject material.

SYN. 331-332 FILAMENT YARN LABORATORY (0-3) (0-3)2
Prerequisite or Concurrent Subject: SYN. 301
Required in Course V — PROF. FREDERICK AND MR. PFISTER

This subject covers the laboratory aspects of SYN. 301, and consists of planned experiments and demonstrations involving the use of throwing machinery and processes by the student. Experiments include various yarn soaking studies, winding, twisting, coning and single end sizing operations, and quality control and power studies.

Syn. 411-412 PROPERTIES AND APPLICATIONS OF SYNTHETIC FIBERS (3-0) (3-0)6

Prerequisite: Syn. 312 — Prof. Harris

Required in Course V

This subject is a continuation of Syn. 312. Much of the time will be spent on considerations of the fundamental properties of man-made fibers in relation to each other and to the behaviors of the finished textile resulting from these basic properties and the geometry imposed upon the fibers in the textile. To make the material more useful, comparisons are made with natural fibers and their textiles. Recent advances in the manufacture and study of fibers will be discussed whenever necessary to keep the subject matter included in Syn. 311 and 312 up to date.

Syn. 452 SYNTHETIC TEXTILES SEMINAR (2-0)2

Prerequisites: Syn. 302 *and* 411 — Profs. Harris and Frederick

Required in Course V

A general discussion of the problems encountered in the synthetic textile field, including economics, manufacture, processing, properties and various aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar develops an objective viewpoint of the subject by the student.

TEXTILES — GENERAL

Tex. 302 FABRICS (3-0)3

Prerequisites: Des. 101 *and* 103 *or* Des. 102 *and* 104 — Prof. Golec

Design Major Prerequisites: Des. 204 *and* 212

Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

This subject is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial uses. An analytical discussion is used so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc., used.

Tex. 311-312 TEXTILE TESTING (2-2) (2-2)6

Prerequisites: Chem. 102, Math. 102 *and* Phys. 202 — Prof. Frederick and Mr. Pfister

Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

This subject is designed to provide a foundation for more advanced work in testing, and is of sufficient breadth to benefit those students whose main need is an understanding and appreciation of the scope of testing and evaluation in the textile industry. The subject matter covers an applied approach to the statistical treatment of experimental data, and the basic mechanical or physical, chemical, and optical tools and techniques available to the industry for product control, development, and evaluation. Primary emphasis is placed upon an understanding of the principles involved and an integration of the various phases of textile testing into a unified whole.

Tex. 501 or 502 METHODS OF RESEARCH (2-0)2

Prerequisite: Graduate Students only — Profs. Ball and Harry C. Brown

A seminar to familiarize the student with the philosophy and methods of re-

search, current problems in textile research and of the further use of textile literature.

TEX. 590-591 THESIS RESEARCH
Credits and hours to be arranged

WEAVING

WEAV. 201-202 WEAVING (2-3) (2-3)6
Required in Course III PROF. ARMSTRONG AND MR. WOIDZIK

The first semester's work deals with the study of the cam loom, its principal and auxiliary motions, a comparison with other types of looms, and a study of weaving terms and cloth defects in the weaving process. Narrow fabric weaving is incorporated in the laboratory exercises. The second semester's work covers all methods of warp preparation of all yarns with emphasis upon the conditions favorable to each or combinations of systems.

WEAV. 211-212 WEAVING FOR MANUFACTURERS (2-2) (2-2)5
Required in Courses I, II and V PROF. ARMSTRONG AND MR. WOIDZIK

This subject is similar to WEAV. 201-202, but utilizes less laboratory time.

WEAV. 221-222 WEAVING FOR ENGINEERS (2-0) (2-0)4
Required in Course VI-G PROF. ARMSTRONG AND MR. WOIDZIK

This subject, designed for non-manufacturing majors, includes lecture material similar to that in WEAV. 201-202, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 301-302 WEAVING (2-3) (2-3)6
Prerequisite: WEAV. 201 PROFS. HOELLRICH
Required in Course III AND MERRILL

This subject covers dobby weaving and includes single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing, and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics and silk. This subject also covers pile cloth weaving, carpet weaving, and leno weaving.

WEAV. 311-312 WEAVING FOR MANUFACTURERS (2-2) (2-2)5
Prerequisite: WEAV. 201 *or* 211 PROFS. HOELLICH
Required in Courses I, II, and V AND MERRILL

This subject is similar to WEAV. 301-302, but utilizes less laboratory time.

WEAV. 321-322 WEAVING FOR ENGINEERS (2-0) (2-0)4
Prerequisite: WEAV. 201 *or* 211 *or* 221 PROFS. HOELLRICH
Required in Course VI-G AND MERRILL

This subject, designed for non-manufacturing majors, includes the same lecture material as WEAV. 301-302, but includes no laboratory work other than lecture-demonstration and assignments.

WEAV. 333-334 WEAVING FOR ENGINEERS (1-2) (1-2)3
Prerequisites: DES. 223, 233 *or* DES. 224, 234
Required in Courses VI-E and VII
PROF. MERRILL AND MR. WOIDZIK

This subject covers warp preparation and weaving with emphasis on basic principles, eliminating details. The different systems of warp preparation are described and compared. Each type of loom is described, and the capabilities and limitations of each are discussed. Considerable time is devoted to fabric defects, their cause and correction.

WOOL

WOOL 111 or 112 SURVEY OF WOOL MANUFACTURE (2-0)2
Open only to students in Course IV
PROF. KENNEDY

This subject is designed to give those majoring in chemistry a comprehensive survey of woolen yarn manufacture, worsted yarn manufacture, reprocessed and reused fiber, rag picking, garnetting, stock carbonizing, top making and converting of synthetic tow to sliver on the Pacific Converter.

WOOL 211-212 TOP MAKING (2-6) (2-6)8
Prerequisites: ENG. 102 *and* 112
Required for Course II
PROF. KOROSKYS

This subject covers a study of the preparation of wool and allied hair fibers for processing on all systems of manufacture. Special emphasis is placed on wool buying, grading, sorting, scouring and drying, carbonizing, burr picking, worsted carding, backwashing, gilling, Warner Swasey Pin Drafter, Holdsworth's Gill Reducer, Pacific Evenness Tester, Noble combing, tow to top conversion of synthetic fibers, Pacific Converter, top testing, and a study of classification of commercial tops.

WOOL 215-216 TOP MAKING (2-2) (2-2)6
Prerequisites: ENG. 102 *and* 112
Not open to students in Course II
Required in Course VI-G
PROF. KOROSKYS

This subject covers the same lecture material as WOOL 211-212, but the laboratory time is considerably reduced.

WOOL 301-302 WOOLEN YARNS (2-4) (2-4)7
Prerequisite: WOOL 212 *or* 216
Required for Course II
MR. BROWN

This subject covers woolen system fiber blending, oiling, picking, carding, spinning, twisting, and the handling of reused and reprocessed fiber. Old rags and new clips are graded and sorted. Rag sources are covered as are rag picking, lumping, shredding, garnetting and complete manipulation from reprocessed clips and waste to fiber ready for carding and making into yarn. The processing of wool, manufactured, and synthetic fiber, is studied in theory and practice. Special emphasis is given to details of woolen machinery such as tape and ring doffer type condensers, broadband and Apperly intermediate feeds, automatic weighing feeders, peralta rolls, card drives, and modern mule and ring spinning. The lecture study is augmented with many laboratory experiments and problems which are performed by the student.

Wool 311 or 312 SURVEY OF WOOL MANUFACTURE (3-1)3

Prerequisite: Tex. 102 *suggested but not obligatory*

Required in Courses I, III, IV, V, VI-E and VII

Prof. Kennedy

Not open to students in Course II or VI-G

This subject is designed for those who are not majoring in wool manufacture and presents a comprehensive survey of woolen and worsted yarn, reprocessed and reused fiber, and felt manufacturing processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

Wool 321-322 WORSTED YARNS (3-5) (3-3)9

Prerequisite: Wool 212 *or* 216 Prof. Burtt

Required for Course II

This subject consists of both lectures and laboratory work. It supplements the subject matter given in course 211-212, Top Making. Lectures cover advanced gilling; French combing; top analysis and stapling; worsted yarn manufacture, including drawing, spinning, and twisting for both the English and French systems; colored blending of dyed wool tops, also blending wool top with other fibers. The laboratory work covers each phase of the lecture work. Experiments run concurrently with the lectures. Gilling theories are demonstrated; French combing wool is processed into top on the French comb and both French and English system yarns are manufactured. Fundamentals are stressed in both lectures and laboratory. Experiments are run on super draft drawing and spinning frames.

Wool 323-324 WOOLEN YARNS (2-2) (2-2)5

Prerequisite: Wool 212 *or* 216 Mr. Brown

Required in Course VI-G

Not open to students in Course II

This subject covers the same lecture material as Wool 301-302, but the laboratory time is reduced.

Wool 325-326 WORSTED YARNS (3-2) (3-2)7

Prerequisite: Wool 216 Prof. Burtt

Required in Course VI-G

Not open to students in Course II

This subject covers the same lecture material as Wool 321-322, but the laboratory time is considerably reduced.

Wool 411 WOOLEN AND WORSTED MILL ORGANIZATION (4-0)4

Prerequisites: Wool 302 *and* 322 Staff

Required for Course II

This subject covers a recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system of manufacture.

It also summarizes previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades to cover balanced mill equipment necessary to produce worsted cloth from wool top on both English and French systems of manufacture.

HONORARY DEGREE RECIPIENTS

MASTER OF SCIENCE

COMMENCEMENT 1950

Honorable Paul Andrew Dever
Samuel Pinanski
Edward Robinson Schwarz
Abbot Stevens
George Herbert Varney

COMMENCEMENT 1951

John Henry Dillon
Herman Feldman
Kenneth Russell Fox
Ralph King Hubbard
Francis Wilford White

SPECIAL CONVOCATION—December 1951

Edward Thomas Pickard
Harold Watson Leitch
Walter Julian Hamburger
George Tucker Metcalf
Charles Sawyer

DEGREES CONFERRED IN 1951

Bachelor of Science in Textile Chemistry

Frederick Donald Brown
*Alfred Louis Cate
Paul Conlon Cassidy
*Francis Joseph Craven, Jr.
*Robert Michael Creegan
*Ruth Elinor Denio
Joseph James Ducharme
*Martin Isaac Finkelstein
Robert Herbert Freeman
*Leonard Irwin Gilman
Gerald Mark Greenberg
John James Kelleher
Walter John Kosowicz
Leo Eugene Labrecque
Wayne Herbert Lawson
Albert Milton Levenson
Thomas Joseph McKone
Robert Eugene Morrison
Joseph Donald Noonan
Joseph Salvatore Panto
Gregory Joseph Pelliccione
Raymond John Quinn
*Ludwig Rebenfeld
*Eric Alan Schlaginhaufen
Robert Kenton Shaughnessy
*Robert Warren Sumers
Henry John Swiatek
Francis Paul Tully
Paul Raymond Tully
James Webster Whitworth
Donald Wiener
*Samuel Anthony Wood

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*Tau Epsilon Sigma (Textile Scolastic Society)

Bachelor of Science in Textile Manufacturing

Edward Moseley Abbot, Jr.
David Marshall Abrahamson
*Martin David Arsham
Howard Lee Averbach
Apostolos Christos Bazakas
Nishan Boghosian
†Robert William Bussiere
Joseph Henry Charewicz
Joseph John Churchville
Henry James Corcoran, Jr.
*Robert Charles Cottrell
Norman Oliver Daveau
Thomas Eidlitz
Herbert William Feitelson
Robert Antoin Fitzgerald
†*Norman D. Gale
John Edwin Glidden
Murray Myles Goldberg
Alfred Edward Guidotti
Harry Harmon Holmberg
†*Roger Williams Jackle
David Karpoff
Richard Conover Keith
Edward Francis Kelley, Jr.
John Henry Knight
Simon Levy
Charles Abbott Little
Marvin Luba
*Allan Stuart Lyons
Kenneth Edward Miller
Edward Sharon Morris
Leonard D. Murmes
*Irwin R. Needle
Earl James Nickerson
Ira H. Pantell
†Kit Carson Patrick
Wilmer Pofcher
†Francis Thomas Reilly
Stanley Rosenkrantz
Seymour Stone Rostler
†*Peter Marcel Rowe
William Eugene Ryan
Jerome Stanley Schrager
Hersch David Seigel
Harvey David Shapley
Melvin S. Sheroff
Bernard Silver
†Morris Harvey Socransky
Leonard Solov
Robert Weeks Spencer
Alfred Eugene Stein
*Herschel Sternlieb
W. Michael Teta
Michael Neville Teubal
Theodore R. Trilling, Jr.
Nathmal Vyas
*James Paul Wang
*Kenneth Lincoln Whitney

Bachelor of Science in Textile Engineering

*Irwin Maxwell Ames
*Marvin Aronowitz
Stanley Theodore Athas
Robert Lloyd Berwick
Frederick Bedell Bischoff
Joseph Bloomenfeld
Warren Thomas Buchanan
*Abraham Cahano
Richard William Coombes
Paul Swan Cushman
*Evans Reade Davis
Paul Maurice DesCoteaux
Blair Robertson Duncan
Clinton Louis Eklund
Gerald William French
Paul Charles Girouard
*Dorrance Haven Goodwin
*Charles Andrew Goulekas
Philip Wesley Haley
*Melvin Arthur Halpern
Thomas David Higgins
*Gerard Hirschhorn
Edward George Hochberg
Charles Harry Kohnfelder
*Melvin Bernard Landis
†Charles Francis Linberg
Thomas Joseph Maguire
William Cornet Menzies, Jr.
Kenneth Stephen Merrill
Arthur Paul Miller
Albert Thomas Monaco
Roger James Murphy
*Kenneth Bernard Newell
William Robert O'Donnell
Donald Forrest Richardson
Leonard Rawitz
*Richard Seymour Roberts
Lawrence Francis Ryan, Jr.
Jay Stuart Salomon
Shmaryahu B. Shenkar
*Arthur Joseph Weldon

*Tau Epsilon Sigma (Textile Scholastic Society)
†In absentia

Master of Science in Textile Chemistry

Thomas Garrett Casey
B.S., Lowell Textile Institute, 1950

Irving Wyman Feyler, Jr.
B.S., Lowell Textile Institute, 1950

Leo Peter Gaidis
B.S., Lowell Textile Institute, 1950

Arthur Norman Green
B.S., Brown University, 1949

Joan Louise Lent
B.S., Lowell Textile Institute, 1950

Nathaniel Abraham Matlin
B.S., Lowell Textile Institute, 1950

Basil George Skalkeas
B.T.C., Lowell Textile Institute, 1941

Robert Warren Sumers
B.S., Lowell Textile Institute, 1951

Master of Science in Textile Manufacturing

Joseph Fishback
B.S., Lowell Textile Institute, 1950

Arnold Murray Horwitch
Ph.B., University of Chicago, 1948

John Francis O'Donoghue, Jr.
B.S., Lowell Textile Institute, 1950

Master of Science in Textile Engineering

†Pei Chung Chao
B.S., Lowell Textile Institute, 1950

Frederick Walter Nystrom
B.S., Lowell Textile Institute, 1949

Gerald Jackson Patton
B.S., U. S. Naval Academy, 1944

James Aaron Smith
B.S., U. S. Naval Academy, 1944

†Henry Kyi-oen Woo
M.S., Lowell Textile Institute, 1948
B.S., St. John's University, 1939

†In absentia

REGISTER OF STUDENTS

GRADUATE STUDENTS

ARONOWITZ, MARVIN, VI, Paterson, N. J.
B.S., Lowell Textile Institute, 1951
BHATTACHARYA, UMAKANT, VI, Calcutta, India
L.T.M., Victoria Jubilee Technical Institute, 1944
BILBAO, BENJAMIN BAUTISTA, IV, Colombia, S. A.
B.S., Atlantic University, 1949
BISCHOFF, FREDERICK BEDELL, VI, Wilmington, Mass.
B.S., Lowell Textile Institute, 1951
CALVO, JAIME SALAS, VI, Santiago, Chile
C.E., Universidad Catolica de Chile, 1950
CATE, ALFRED LOUIS, IV, Lawrence, Mass.
B.S., Lowell Textile Institute, 1951
DENIO, RUTH ELINOR, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1951
DESCOTEAUX, PAUL MAURICE, VI, Lowell, Mass.
B.S., Lowell Textile Institute, 1951
FEYLER, DONALD P., IV, Chelmsford, Mass.
B.S., Lowell Textile Institute, 1950
FINNIE, TREVOR ALEXANDER, IV, Montreal, Canada
B.Sc., Sir George Williams College, 1951
FOX, NORMAN JAMES, IV, New York, N. Y.
B.S., Seton Hall University, 1951
GREENBERG, GERALD MARK, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1951
HOBBS, ALFRED KEAN, VIII, New Rochelle, N. Y.
B.S., University of Maine, 1950
JORDANIDES, GEORGE ALEX, VI, Athens, Greece
B.S., Bradford-Durfee Technical Institute, 1950
LIU, ANDREW TZE-CHIU, IV, Hong Kong, China
B.S., Indiana University, 1951
MENIRU, GODWIN UDEGBUNAM, VI, Aba, Nigeria
B.S., Howard University, 1951
O'DONNELL, WILLIAM ROBERT, VI, Lowell, Mass.
B.S., Lowell Textile Institute, 1951
ORTIZ, FELIX LUIS, VI, Caguars, Puerto Rico
B.S.M.E., College of Agriculture and Mechanical Arts, 1948
*ROBSON, DANIEL RIGGS, III, Lowell, Mass.
SAFIOEN, R., IV, Tamahasan, Indonesia
B.Sc., S.K.S.J., Technological Institute, 1951
SETTY, ANATHA KRISHNA, IV, Bangalore, India
B.Sc., Technologlical Institute,1950
*SHIPPEE, FRED BOSWELL, IV, Danielson, Connecticut
TENG, THOMAS CHIH-HSIUNG, V, Shanghai, China
A.B., Princeton University, 1950
VYAS, NATHMAL, VI, Bikaner, India
B.S., Lowell Textile Institute, 1951
WANG, JAMES PAUL, I, Shanghai, China
B.S., Lowell Textile Institute, 1951
WOOD, SAMUEL ANTHONY, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1951

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*Candidate for the degree of Bachelor of Science in June, 1952.

UNDERGRADUATE STUDENTS

CLASS OF 1952

Aelion, David Leon, VI .... Alexandria, Egypt
Aldrich, Donald Winthrop, III .... No. Tewksbury, Mass.
Allen, Curtis Carleton, II .... Milton, Mass.
Allison, John Harold, VI .... No. Andover, Mass.
Aptaker, Erwin Malcolm, VII .... Revere, Mass.
Aronson, Richard Lee, V .... Great Neck, N. Y.
Axon, Gordon Lysle, IV .... Chelmsford, Mass.
Barr, Robert Sutherland, VI .... Amesbury, Mass.
Barry, Gerald Francis, IV .... Lowell, Mass.
Beaulier, Vernon, James, VIII .... Lowell, Mass.
Becker, Marvin Franklin, V .... Brooklyn, N. Y.
Becker, Robert Ivan, VI .... Leicester, Mass.
Belanger, Wilfred Edmond, IV .... Lowell, Mass.
Bell, Gilbert Carter, VI .... Lowell, Mass.
Benjamin, Albert, III .... Brooklyn, N. Y.
Bernstein, Milton, Jacob, III .... Paterson, N. J.
Bird, Marshall Coles, II .... Ware, Mass.
Bloch, Manfred Gunter, VI .... Tel-Aviv, Israel
Boches, Milton, IV .... Lowell, Mass.
Bodor, Stephen Joseph, VI .... Lynn, Mass.
Boutin, Francis E., VI .... Lawrence, Mass.
Brissette, Richard Stacy, VI .... Rockford, Ill.
Bromley, John Eberbach, VI .... Abington, Pa.
Brown, Perry Horton, VI .... Marblehead, Mass.
Bussiere, Kirk, III .... Needham, Mass.
Carroll, William Henry, III .... Medford, Mass.
Claridge, Arthur Whittier, VI .... Marlboro, Mass.
Coffin, Laurance Gregory, VI .... Port Chester, N. Y.
Desrochers, Roland Joseph, VI .... Franklin, N. H.
Dersh, Harvey Arthur, VI .... Brooklyn, N. Y.
Deschamps, Joseph Raymond, II .... Lawrence, Mass.
Dickison, Bruce Osborne, IV .... Lowell, Mass.
Dole, Gordon Shattuck, VI .... Bristol, N. H.
Donoian, Haig Cadmus, IV .... Lowell, Mass.
Dooley, Donald David, IV .... Lowell, Mass.
Draper, Richard Leonard, I .... Hopedale, Mass.
Dupuis, Amedee James, VI .... Lowell, Mass.
Eklund, Richard Thorp, IV .... Lowell, Mass.
Engelhardt, Bernard Herbert, VI .... Brooklyn, N. Y.
Feinberg, Bertram, III .... Forest Hills, N. Y.
Finegold, Donald Erwin, IX .... Peabody, Mass.
Fisher, Lawrence Wallace, IV .... Woburn, Mass.
Fulginiti, Panteleone, Samuel, VI .... Worcester, Mass.
Giard, Edward Henry, IV .... Black Mountains, N. C.
Ginsburg, Alan, IV .... Brooklyn, N. Y.
Gladstone, Milton Harvey, V .... Brooklyn, N. Y.
Goven, Earl Joseph, I .... Wauregan, Conn.
Grady, Douglas Francis, I .... Palisades Park, N. J.
Graham, Everett H., VI .... Graniteville, Mass.
Grill, Joel Harvey, VI .... Brooklyn, N. Y.
Haddad, Herbert Lawrence, VI .... Iselin, N. J.
Hixon, Wesley Francis, I .... Hopedale, Mass.

Hochfeld, Michael, IV .... Bronx, N. Y.
Hochner, Walter Leo, IV .... Kew Gardens, N. Y.
Hocking, Winfred Thomas, VI .... Lowell, Mass.
Johnson, Paul Lester, VI .... Lowell, Mass.
Kalantzakos, Nicholas, VI .... Lowell, Mass.
Kaye, Irwin, VII .... Brookline, Mass.
Kaye, Michael Bondy, V .... New York, N. Y.
Keenan, Ursula Frances, III .... So. Boston, Mass.
Komins, Burton Louis, IV .... Brookline, Mass.
Koza, Walter Mitchell, VIE .... Lowell, Mass.
Kupferman, Arthur, VII .... Bronx, N. Y.
LaPlante, Richard Haynes, IV .... Lowell, Mass.
Lee, Laurence, Chih-liang, I .... Shanghai, China
Lein, Sherman, IV .... Brooklyn, N. Y.
Levenson, Richard Norman, VII .... Brookline, Mass.
Lewis, Francis Augustus, VI .... Dedham, Mass.
Lewis, Roger Alan, VI .... Chelmsford, Mass.
Liacopoulos, Nicholas Constantine, VI .... Lowell, Mass.
Liston, Florence Patricia, IV .... Lowell, Mass.
Longbottom, Parker Wyman, IV .... Claremont, N. H.
Lynch, William Paul, VI .... Lowell, Mass.
MacLean, Harold John, VI .... Lowell, Mass.
McCartney, Donald James, IV .... Lowell, Mass.
McEwen, Thomas Arthur, II .... Webster, Mass.
McKeon, Richard Francis, VI .... No. Adams, Mass.
McKone, Henry James, VI .... Lowell, Mass.
McNulty, Denis, Michael, II .... Dorchester, Mass.
Mack, Charles Harris, VII .... Cape Elizabeth, Me.
Mann, Warren Eugene .... Troy, N. Y.
Mettler, Edward, VI .... Queens, N. Y.
Michaels, Charles Sylvester, II .... N. Bellingham, Mass.
Mills, Harold George, I .... Auburn, Me.
Montgomery, Richard H., VI .... Chelmsford, Mass.
Morris, Joseph Charles, VI .... Long Beach, N. Y.
Mullen, Arthur Leo, Jr. II .... Dedham, Mass.
Nelson, Charles David, IV .... Groveland, Mass.
Nestervich, Michael, III .... Claremont, N. H.
O'Donnell, John Thomas, IV .... Lowell, Mass.
O'Leary, Thomas Francis, I .... Belmont, Mass.
Olney, Robert Albert, IV .... Forest Hills, N. Y.
Peters, Margaret Jean, IV .... Lowell, Mass.
Pihl, Donald Greenwood, VI .... Lowell, Mass.
Platt, James Rudman, VI .... W. Sand Lake, N. Y.
Polak, Frank Walter, VII .... Lowell, Mass.
Prudenti, Joseph John, VII .... Boston, Mass.
Robinson, Bertram Robert, Jr., VI .... Lowell, Mass.
Robson, Daniel Riggs, III .... Lowell, Mass.
Rogers, Miriam Ruth, VI .... Brooklyn, N. Y.
Roth, Irwin Jay, VII .... Rego Park, N. Y.
Roux, Joseph Alexander, IV .... Lowell, Mass.
Ruta, Stanley Anthony, V .... Lowell, Mass.
Rutledge, Robert John, Jr. VI .... Lowell, Mass.
Scagos, George Angelos, IV .... Lowell, Mass.
Schaff, Donald John, IV .... Fair Lawn, N. J.
Scott, Wemyss Ballentine, Jr., III .... Rochester, N. Y.
Sherburne, Edwin Collier .... Tyngsboro, Mass.
Shippee, Fred B., IV .... Danielson, Conn.

Simmons, Robert Arthur, IV .... Lowell, Mass.
Singer, Eric, VI .... New York, N. Y.
Smoler, Avrum David, VII .... New York, N. Y.
Stanton, Joseph Michael, Jr., VI .... Tewksbury, Mass.
Stein, Harold Murray, VI .... Lowell, Mass.
Stone, Harold Richard, II .... Woonsocket, R. I.
Szczepanik, Henry Myron, IV .... Lowell, Mass.
Tessler, Ramon Norman, VII .... Kew Gardens, L. I., N. Y.
Therrien, Bernard Edmund, IV .... No. Adams, Mass.
Thibodeau, Walter Norman, IV .... Bristol, Conn.
Tingas, Arthur Stefanos, VI .... Lowell, Mass.
Tosone, Mario Carmen, IV .... Lawrence, Mass.
Travis, Lazarus, V, ... Brookline, Mass.
Wasserman, Bernard, VII .... Providence, R. I.
Watt, Charles Edward, Jr., VI .... Chelmsford, Mass.
Winn, Irving Woodman, Jr., I .... Lisbon Falls, Me.
Wise, Ralph LeRoy, IV .... Lowell, Mass.
Wood, Eugene Jackson, Jr., VI .... Groton, Mass.
Zoglio, Eleanor Barbara, IV .... Lawrence Mass.
Yelenides, Jordan P., VI .... Athens, Greece

CLASS OF 1953

Abrahams, David Hillel, IV .... Cliffside Park, N. J.
Adell, Robert Godfrey, IV .... Dorchester, Mass.
Adler, Edward Jerome, VI .... New York, N. Y.
Albani, Robert Francis, VI .... Hyde Park, Mass.
Arnold, Edward, IV .... Revere, Mass.
Baerwald, Edgar Arendt, II .... Santiago, Chile
Bagdon, Herbert C., VI .... Millburn, N. J.
Barber, Herbert, VI .... Bronx, N. Y.
Barrett, James Joseph, VI .... Waban, Mass.
Baxter, George Lytton, IV .... Briarcliff, N. Y.
Beals, Richard Allen, VI .... Springvale, Me.
Beder, Abner Meyer, VI .... Brooklyn, N. Y.
Bedrosian, Peter, IV .... Haverhill, Mass.
Berger, Stanley, III .... Bronx, N. Y.
Binns, Robert Albert, VI .... No. Andover, Mass.
Boutiette, James Paul, VII .... Farnumville, Mass.
Brandman, Monte, Ira, VII .... Brooklyn, N. Y.
Brandt, Sanford, VI .... Little Neck, N. Y.
Brody, Arnold Allan, VI .... Brooklyn, N. Y.
Burns, Edward Charles, VI .... Lowell, Mass.
Bussiere, William Raymond, V .... Lewiston, Me.
Carroll, John Neil, V .... Medford, Mass.
Carty, William David, VI .... W. Medford, Mass.
Cobin, Howard Charles, IV .... Brookline, Mass.
Copley, William Morgan, IV .... Lowell, Mass.
Cross, Robert James, VI .... No. Chelmsford, Mass.
Danza, Lawrence Benjamin, VI .... Keyport, N. J.
Darsch, Charles George, Jr., VI .... No. Plymouth, Mass.
David, John Bernard, Jr., II .... Dudley, Mass.
DeFusco, William Joseph, VI .... Lawrence, Mass.
Demas, Harry John, IV .... Athens, Greece
Devereaux, John Lawrence, II .... W. Roxbury, Mass.
Dielendick, Michael, II .... Haverhill, Mass.
Dudgeon, Edward Kingston, IV .... Sanford, Me.

Engel, Richard Brom, V ....Elmhurst, L. I., N. Y.
Essig, Abe Wilder, VI ....New York, N. Y.
Finegold, Donald Erwin, IX ....Peabody, Mass.
Fishman, Harvey Martin, IV ....Brooklyn, N. Y.
Flamand, Charles David, IV ....Northbridge, Mass.
Flannery, Joseph Patrick, IV ....Lowell, Mass.
Freeman, Arnold Joel, VII ....New York, N. Y.
Froehlich, Eugene Ferdinand, II..New York, N. Y.
Girard, Roger Donald, V ....Lowell, Mass.
Godfrey, Robert Steward, VI ....Andover, Mass.
Goodman, Leonard, VI ....Brooklyn, N. Y.
Gosselin, George Joseph, Jr., VI ....Lawrence, Mass.
Goulart, Richard Francis, II ....Cambridge, Mass.
Greenberg, Robert Morris, IV ....Brookline, Mass.
Grubman, Leonard, VI ....Lowell, Mass.
Hall, Richard King, IV ....Lowell, Mass.
Haley, Lawrence Anthony, VI ....Harvard, Mass.
Hamel, Gerald Roland, VI ....Lowell, Mass.
Haralampopoulos, Harry N., IV ....Nashua, N. H.
Hurrahy, Donald James, VI ....Worcester, Mass.
Harris, Paul David, VI ....New York, N. Y.
Hilliard, Everett Alvah, Jr., VI ....Lowell, Mass.
Hudson, Ralph Edward, Jr., VI..Attleboro, Mass.
Kamerman, Kenneth, VI ....Brooklyn, N. Y.
Kaslow, John Francis, VI ....No. Andover, Mass.
Kelleher, Robert Ralph, VI..Arlington, Mass.
Kelley, Richard Jewett, IV ....Lowell, Mass.
Khoury, Ernest Joseph, IV ....Lawrence, Mass.
Langlais, Roger John, IV ....Lowell, Mass.
Lawrence, George Campbell, II..Dracut, Mass.
McHugh, Warren Paul, II ....Chelmsford, Mass.
McKniff, Francis, V ....Forge Village, Mass.
MacLellan, Neil Jr., II ....Larchmont, N. Y.
Madans, Jerome Irwin, I ....New York, N. Y.
Magnant, Alfred Joseph, VI ....Rye, N. Y.
Mulcahy, Robert Edward, V ....Arlington, Mass.
Nachman, Stevens Gunther, II ....Kew Garden, N. Y.
Nelligan, James Anthony, V ....Lowell, Mass.
Nogueira Alberto, DeVasconcelos, IV..Paceio-Alagoas, Brazil
Nordon, Franklin A., VI ....Medford, Mass.
Norman, William Arthur, VI ....Hopedale, Mass.
Ostrove, Donald Martin, VII ....Long Beach, N. Y.
Paris, Irin Myron, III ....Fair Lawn, New Jersey
Pawlowski, Frederick Francis, VI ....Lowell, Mass.
Pecci, Raymond, IV ....Lawrence, Mass.
Peltekian, Stephen, A., V ....Athens, Greece
Pihl, Carl Frederick, VIII ....Henniker, N. H.
Polak, Walter Frank, V ....Lowell, Mass.
Profio, Robert Michael, IV ....Lowell, Mass.
Ramachandran Kandaswamy V., I ....Coimbatore, South India
Randall, Thomas Henry, IV ....Chelmsford, Mass.
Richardson, Maurice W., Jr., VI..Amsterdam, N. Y.
Robey, Robert Versal, VI ....Chelmsford, Mass.
Robinson, Bertram Robert, Jr., VII ....Lowell, Mass.
Rocha, Manuel Medeiros, VI ....Dedham, Mass.
Rottenberg, Ira Morvay, I ....New York, N. Y.
Saks, Morton, Ira, I ....Brooklyn, N. Y.

Sanborn, Roger, James, V .... Lowell, Mass.
Schain, Jerry Laurence, V .... Bronx, N. Y.
Scheier, Stanley Charles, VI .... New York, N. Y.
Shantzis Murray Mark, VI .... New York, N. Y.
Sidelinker, Earl, V .... Lowell, Mass.
Siegal, Donald, VII .... Lowell, Mass.
Smith, Donald Bishop, VI .... Stow, Mass.
Smith, Robert Frank, III .... Lawrence, Mass.
Smith, William Richard, IV .... Tewksbury, Mass.
Stone, David Charles, VII .... Brooklyn, N. Y.
Swanson, Morris Harvey, VI .... Westford, Mass.
Tanzer, Kenneth Elliott, IV .... New York, N. Y.
Tewksbury, Charles Goward, VI .... Lowell, Mass.
Uster, William Henry, VII .... Rutherford, N. J.
Velantzas, James Anastas, IV .... Lowell, Mass.
Walsh, John Vincent, VI .... Whitinsville, Mass.
Wark, Donald Thomas, IV .... Newton, Mass.
Wiener, Melvin, V .... Brooklyn, N. Y.
Wuester, Erwin August, III .... Riverdale, N. J.
Zagel, Itzhak, VI .... Tel-Aviv, Israel

CLASS OF 1954

Adler, Stephen Emil, II .... Danbury, Conn.
Applebaum, Robert, VI .... New York, N. Y.
Asher, Surendra, P., I .... Bombay, India
Auffinger, William Michael, II .... Watertown, Mass.
Austin, David Irving, II .... Reading, Mass.
Baevsky, Marvin Arthur, VI .... Springfield, Mass.
Berkowitz, I. Milton, VI .... New York, N. Y.
Berlyn, Gerald Elliot, VI .... Northboro, Mass.
Berman, Harry, V, ... Brooklyn, N. Y.
Bonacci, Edward Louis, VI .... Yonkers, New Yofk
Brier, Daniel Lewis, VI .... Far Rockaway, N. Y.
Brodrick, George Joseph, Jr., II .... Clinton, Mass.
Brown, William, VI .... Scranton, Penn.
Carolean, Francis James, IV .... Lowell, Mass.
Cashin, Charles Luther, II .... Chelmsford, Mass.
Cassidy, Robert Thomas, VI .... Lowell, Mass.
Cate, Alan Clifford, VI .... Lawrence, Mass.
Cherry, Jay Leonard, II .... Swampscott, Mass.
Cohen, Ronald Ainesworth, IV .... Lowell, Mass.
Cole, Franklin Bruce, III .... Auburn, Maine
Collins, Edward James, VI .... Lowell, Mass.
Conley, John Theodore, I .... Warren, Rhode Island
Cryan, Arthur Philip, Jr., VIII .... Lowell, Mass.
Dooley, William Eugene, IX .... Lowell, Mass.
Doyle, Russell Paul, IX .... Lowell, Mass.
Ducharme, Jean-Charles, VI .... Orleans, Mass.
Ettenson, Melvin Walter, VI .... Elmont, New York
Fairfield, Hugh Carlton, II .... Winnipeg, Manitoba
Fattah, Muwaffaq Nouri, II .... Baghdad, Iraq
Fisher, Robert Joseph, II .... E. Paterson, N. J.
Flint, Harry Edwin, VI .... Lawrence, Mass.
French, Kenneth Allan, VI .... Arlington, Mass.
Fulton, Robert Fraser, IX .... Dracut, Mass.

Gabriel, William George, VII .... Flushing, N. Y.
Garrett, Owen Loran, VI .... Lowell, Mass.
Garvey, Thomas Francis, IV .... Lowell, Mass.
Genereux, Albert Joseph, VI .... Webster, Mass.
Gillie, Stanley James, VI .... Foxboro, Mass.
Ginsburgh, Jerome Herbert, VI .... Brooklyn, N. Y.
Glasheen, Edward Arthur, VIII .... Lowell, Mass.
Goldsmith, Elliott Bernard, IV .... Brooklyn, N. Y.
Good, Lincoln Hovey, VI .... Lexington, Mass.
Gottschalk, Ernest, V .... Kew Gardens, L. I., N. Y.
Grant, Arwilda Ann, IV .... Lawrence, Mass.
Greenhall, Armand Lawrence, IV .... New York, N. Y.
Hallas, Kenneth Barnes, VIII .... Lawrence, Mass.
Hamilton, Henry Ronald, IV .... Woburn, Mass.
Hanson, Donald Baker, VI .... Reading, Mass.
Henry, Archie Joseph, VI .... Lowell, Mass.
Higgins, Charles James, VIII .... Lowell, Mass.
Hodus, Herbert Jack, IX .... Revere, Mass.
Horowitz, I. Laurence, VI .... Hewlett, N. Y.
Iannazzi, Joseph Louis, VI .... Lawrence, Mass.
Kao, Victor T-C., VI .... Shanghai, China
Kennedy, William James, Jr. IV .... So. Hadley Falls, Mass.
Kimmell, Arnold Lawrence, VI .... Lowell, Mass.
Kinney, Georgina Betty, IV .... Lowell, Mass.
Kupferschmid, Bernard, VI .... Buenos Aires, Argentina
Kyriacopoulos, Vasilios, VI .... Lowell, Mass.
Lanthier, Paul Francis, IV .... Dracut, Mass.
Laurion, Tristan Arnold, IV .... Dracut, Mass.
Ledgett, Richard Hugh, IV .... Glen Rock, N. J.
Legge, Robert Wayne, IV .... N. Easton, Mass.
Leventhal, Bernard Alan, VII .... White Plains, N. Y.
Libbey, Arthur Joseph, Jr., IV .... Lawrence, Mass.
Libow, Lauren Earl, VI .... Newton Mass.
Lind, Herbert Clark, VIII .... Chelmsford, Mass.
Llewellyn, Charles Ernest, Jr., VI .... Jamaica Plain
Lorman, Robert John, VI .... Tyngsboro Mass.
McDonagh, Paul Mathew, IV .... Lowell, Mass.
McKenney, Hugh Edward, IX .... Lowell, Mass.
Manuila, Dan Camil, VI .... New York, N. Y.
Marchand, Albert Joseph, VIII .... Lowell, Mass.
Mavro, Othon John, II .... Allston, Mass.
Nichols, Donald Stanley, VI .... Upton, Mass.
O'Sullivan, James Francis, IV .... Groton, Mass.
Oxer, Jerry, II .... Bronx N. Y.
Pearlstein, Donald Michael, VI .... Brooklyn, N. Y.
Pelletier, Andre Joseph, IV .... Lowell, Mass.
Pelliccione, Robert Joseph, VIII .... Lawrence, Mass.
Perra, Paul Gerard, II .... Haverhill, Mass.
Petkiewicz, Francis Louis, IX .... Dracut, Mass.
Pokraka, Earl E., IV .... Pawtucket, Rhode Island
Quealy, Thomas Stephen, IV .... Lowell, Mass.
Reardon, William John, Jr., VI .... Framingham, Mass.
Riley, Charles Philip, Jr., IV .... Lowell, Mass.
Robbins, Walter Archibald, II .... Danville, Va.
Robelo, Cesar Augusto, I .... Managua, Nicaragua
Rogers, Donald Francis, VII .... Lowell, Mass.

Rushton, Warren Stanley, VIII ....Lowell, Mass.
Ryan, John Thomas, IV ....Lowell, Mass.
Sargent, Thomas Joseph, VIII ....Lowell, Mass.
Scarborough, Edgar Jr., VII ....Lowell, Mass.
Scarponi, Othello, VI ....Somerville, Mass.
Shapiro, Bernard, IV ....Lowell, Mass.
Siegal, Gerald Howard, VI ....New York, N. Y.
Smith, Charles Augustus, IV ....Lowell, Mass.
Solkoff, Sidney, VI ....Brooklyn, N. Y.
Steinsapir, Abby Dolber, II ....Santiago, Chile
Sturm, Charles Frank, VI ....Lakewood, N. J.
Swift, Robert Evan, VI ....Tiverton, R. I.
Tabloski, Raymond William, IV ....Lowell, Mass.
Tournas, Arthur, VIII ....Dracut, Mass.
Tully, R'chard Paul, IV ....Lowell, Mass.
Uffner, Jerome Howard, I, ...Bronx, N. Y.
Walshaw, Robert Mahlon, V ....Gretna, Va.
Waugh, Robert William, III ....Andover, Mass.
Weiser, Abram, V ....Lawrence, Mass.
Weissenborn, Florian Julius, I ....Buenos Aires, Argentina
Whitney, Lloyd, Eemore, VI ....Brockton, Mass.
Woessner, Harry Norman, VI....................Lowell, Mass.
Zalechowski, Edwin, VIII ....Lawrence, Mass.

CLASS OF 1955

Abbott, Alden Wayne, II ....Paxton, Mass.
Barrett, Robert Wallace, V ....Malden, Mass.
Bass, Lawrence Maury, VI ....Hillside, N. J.
Berger, Joel, IV ....Brooklyn, N. Y.
Bicknell, Roger Willard, V ....Chelmsford, Mass.
Boches, Gerald Edwin, IV ....Dorchester, Mass.
Bodenhorst, Piet Benzio, IV ....Ambato, Ecuador
Bogart, Joel, II ....Brooklyn, N. Y.
Boyle, John Francis, Jr., V ....Lowell, Mass.
Brodeur, Norman Gille, VI ....Lowell, Mass.
Brosnan, William Thomas, IV ....Newton Highlands, Mass.
Brown, William Watson, V ....Lowell, Mass.
Cameron, Guy Loubier, VI ....Knowlton, Quebec
Canovai, Peter Clement, IV ....Rutherford, N. J.
Casey, James Paul, IV ....Lowell, Mass.
Chinklis, Charles Koulias, IV ....Lowell, Mass.
Chingros, Chris, IV ....New York, N. Y.
Cohen, Allen Charles, VI ....Rosedale, N. Y.
Cohen, Herbert L., VII ....Jamaica, N. Y.
Cole, Franklin Bruce, III ....Auburn, Maine
Cooperman, Alan Norman, VI ....Clinton, Mass.
Crean, Daniel Francis, IV ....Stoughton, Mass.
Donovan, Vincent Paul, IV ....Lawrence, Mass.
Drouin, Roger Eugene, VI ....Lowell, Mass.
Dreisel, William Paul, III ....Methuen, Mass.
Dunigan, Paul Henry, IV ....Graniteville, Mass.
Ectman, Elliot Israel, III ....Winthrop, Mass.
Eddy, Robert George, V ....Roselle Park, N. J.
Eisenberg, Jules Saunders, II ....New York, N. Y.
Fagan, Eric Francis, V ....Lowell. Mass.

Faust, Charles Allan, VIII ..... Lowell, Mass.
Foy, Raymond Leo, VI ..... Lowell, Mass.
Frank, Floyd Ivan, VI ..... Elizabeth, N. J.
Frazee, Donald William, VI ..... Lowell, Mass.
Freeman, Joseph Francis, Jr., III ..... Ayer, Mass.
Frei, William Frederick, VI ..... Teaneck, N. J.
Gallagher, Gerald Thomas, IV ..... Chelmsford, Mass.
Galvin, John Blake, IX ..... Lowell, Mass.
Ganz, James Bernard, VI ..... Brooklyn, N. Y.
Geary, Nancy J., IV ..... Chelmsford, Mass.
Gilet, Albert James, Jr., VI ..... Lowell, Mass.
Gillis, Richard Clarence, III ..... Lowell, Mass.
Gostanian, Edward, VI ..... Buenos Aires, Argentina
Goulston, Paul Milton, IV ..... Stoughton, Mass.
Green, Gerard Kennedy, VI ..... Lowell, Mass.
Grevelis, Theodore George, IX ..... Peabody, Mass.
Guimaraes, Juliovito Pentagna, I ..... M. Gerais, Brazil
Guziejka, Edward Michael, V ..... Lowell, Mass.
Hall, Robert Ayer, V ..... Lowell, Mass.
Hamel, Norman Alfred, IV ..... Dracut, Mass.
Hardy, Frank Raymond, VI ..... Chelmsford, Mass.
Harrington, Paul A., IV ..... Lowell, Mass.
Hayes, Charles Edward, VI ..... Lansdowne, Pa.
Heintz, Kenneth George, III ..... Monson, Mass.
Hince, Lawrence, VIII ..... Lowell, Mass.
Hoffman, Theodore, VI ..... Brooklyn, N. Y.
Horowitz, Arnold Joseph, II ..... Worcester, Mass.
Houston, Bernard Charles, VI ..... Lowell, Mass.
Howarth, Donald Georges, VI ..... Hartford, Conn.
Hyman, Edgar Allan, III ..... Fall River, Mass.
Johansen, Paul Charles, IV ..... Pinehurst, Mass.
Kane, Edward Hugh, VIII ..... Lowell, Mass.
Kappler, Francis Robert, IV ..... Lowell, Mass.
Karp, Herbert Eugene, VIII ..... Lowell, Mass.
Katsaros, Steigios George, VI ..... Lowell, Mass.
Kenney, Elaine Louise, III ..... Lowell, Mass.
Kiluk, Frank J., IV ..... Lowell, Mass.
Knox, James Allison, Jr., VII ..... Reading, Mass.
Krause, George W., VI ..... Brooklyn, N. Y.
Krouss, Stuart, I ..... New York, N. Y.
Langer, Alan Hilton, V ..... Brooklyn, N. Y.
Larose, Francis Alphonse, VIII ..... Lowell, Mass.
Leavitt, Stanley James, VI ..... Springfield, Mass.
LeBovidge, Alfred Joseph, III ..... Dorchester, Mass.
Legow, Donald Martin, VI ..... Newark, N. J.
Leipzic, Paul E., VII ..... Brooklyn, N. Y.
Leirner, Nelson, VI ..... Sao Paulo, Brazil
Levin, William B., IX ..... Peabody, Mass.
Lolos, Demetrios Speros, VI ..... Lowell, Mass.
Lutz, Robert, John, VI ..... Dracut, Mass.
McKone, Francis Leo, IV ..... Dracut, Mass.
McNamara, John Joseph, IV ..... Lowell, Mass.
Maciejewski, Walter Eugene, VI ..... Norwich, Conn.
Madden, Rodney Michael, VI ..... Woburn, Mass.
Marcus, Allen C., I, ... Longbeach, N. Y.
Maynazarian, Richard, III ..... Flushing, N. Y.

Missry, Leon, VI .... Providence, R. I.
Morissette, Edward Paul, VI .... Keene, N. H.
Moissonier, Raymond Amede, VI .... Holyoke, Mass.
Morway, Richard Joseph, IX .... Lawrence, Mass.
Moser, Paul John, VI .... Clifton, N. J.
Moskowitz, Burton B., VI .... Bronx, N. Y.
Nagle, Robert Thomas, VIII .... Lowell, Mass.
Nicalek, John Louis, IV .... Lawrence, Mass.
Noval, George Roland, VIII .... Lowell, Mass.
O'Heir, Albert Edward, VI .... Lowell, Mass.
O'Neill, William John, VI .... Lowell, Mass.
Ouelette, Normand Bernard, III .... Lowell, Mass.
Palm, Gilbert Rogers, VII .... Plainfield, N. J.
Pappaioanou, George James, VI .... Lowell, Mass.
Perkins, Guy Emmanuel, V .... Holyoke, Mass.
Peterson, Albert Carter, VI .... Lawrence, Mass.
Petkiewicz, Chester John, IV .... Dracut, Mass.
Plays, George Lewis, II .... Woonsocket, R. I.
Ponty, Howard Davis, II .... Worcester, Mass.
Powell, Henry Joseph, VIII .... Lowell, Mass.
Reilly, John Rowen, Jr., II .... Brookline, Mass.
Rekant, Seymour, VII .... Providence, R. I.
Ricard, Roderick Rene, Jr., IV .... Lowell, Mass.
Riecks, David Edman, VI .... Billerica, Mass.
Robelo, Fernando Jose, VI .... Managua, Nicaragua
Rogers, David Eldredge, VI .... Wakefield, Mass.
Rosen, Jerome Hirsch, VI .... Long Beach, N. Y.
Roy, Roland Leonel, VI .... Manchester, N. H.
St. Onge, Janet Anne, III .... Lowell, Mass.
Samaras, Peter Nicholas, VIII .... Lowell, Mass.
Samson, Clifton Rockwell, VI .... Eaton, Ohio
Sarmiento, Pedro David, IV .... Ayer, Mass.
Sawyer, Richard Earl, VIII .... No. Billerica, Mass.
Scaringi, John Herbert, IV .... Pinehurst, Mass.
Semple, Donald Howard, VIII .... Lawrence, Mass.
Shanley, Edward Francis, IV .... Lowell, Mass.
Shay, David Henry, IV .... Beverly, Mass.
Sheldon, Edward Bradley, VI .... Easthampton, Mass.
Silverman, Lewis, VI .... Brooklyn, N. Y.
Simoneau, Norman Roger, IV .... Nashua, N. H.
Solomon, Kalman, VIII .... Montreal, Quebec
Soren, Gary Arthur, VII .... New York, N. Y.
Stanley, James Edward, II .... Lowell, Mass.
Stanley, George Aloysious, IV .... Lowell, Mass.
Stone, Carl Alvin, VI .... Rochester, N. H.
Strzelewicz, William Bernard, Jr., VI .... Webster, Mass.
Talford, Eugene Dennis, V .... Lowell, Mass.
Torchia, David Francis, IV .... Stottville, N. Y.
Truche, Raymond Louis, IX .... Salem, Mass.
Truesdale, Elmer Vine, Jr., I, ... Auburn, Maine
Twarog, John Louis, IV .... Dracut Mass.
Unger, Walter James, VI .... Lawrence, Mass.
Velantzas, Fotine, IV .... Lowell, Mass.
Vinios, John Louis, VI .... Lowell, Mass.

SPECIAL STUDENTS

Ang, Jesus, II .... Cal. Rizal, P. I.
Anninos, Athanassios, IV .... Athens, Greece
Aref-Pour, Hossein, VI .... Tehran, Iran
Balacas, Theodore, VI .... Athens, Greece
Chance, Christopher Richard, I, ... Carlisle, England
Coakley, Frances Cooper, III .... Buffalo, N. Y.
Frost, Kent Shuster, II .... E. Douglas, Mass.
Gardiner, Guy Gibson, II .... Newtonville, Mass.
Hausman, Richard Demaret, V .... King's Point, N. Y.
Husson, Teresa, III .... Lowell, Mass.
Kwok, Chi Tao, IV .... Shanghai, China
Melham, Oscar, VI .... Buenos Aires, Argentina
Paquette, Roland Jean, IV .... Montreal, Canada
Parekh, Shashikant Shamji, IV .... Bombay, India
Patten, Richard Adams, VI .... Tewksbury, Mass.
Peckham, Fenner Harris, Jr., VII .... Chelmsford Mass.
Rahman, Abul Fazl Muhammad Hafizar, VI .... Dacca Pakistan
Redman, George Frederick, VI .... No. Andover, Mass.
Reslow, Gunnar Martin, VI .... Lowell, Mass.
Sheard, Douglas, II .... Coaticook, Canada
Soedibjo, Hardjopertomo, IV .... Sleman, Jogja, Indonesia
Starr, Fred, II .... Brooklyn N. Y.
Tracey, Marvin, VI .... Beverly, Mass.
Turoff, Milton, V .... Baldwin, N. Y.
Walker, Robert Joseph, VI .... Westford, Mass.
Wyner, Donald, IV .... New Rochelle, N. Y.

SERIES 56. NO. 1.
CURRICULUM BULLETIN

August, 1952

BULLETIN

of the

Lowell Textile Institute

LOWELL, MASS.

1952-1953

Entered August 26, 1902, at Lowell, Mass., as second-class matter
under act of Congress of July 16, 1894

Textile and Colonial Avenue

DEPARTMENT OF
LOWELL EVENING TEXTILE SCHOOL

Publication of this Document Approved by George J. Cronin, State Purchasing Agent

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TRUSTEES

OF THE LOWELL TEXTILE INSTITUTE

ADMINISTRATION

PRESIDENT
Martin J. Lydon, A.B., A.M. . . . . . Montview Road, Chelmsford

DIRECTOR OF EVENING SCHOOL
Charles F. Edlund, S.B., Ed.M. . . . . . 68 Baldwin Street, Lowell

ASSISTANT DIRECTOR OF EVENING SCHOOL
Charles L. Daley, B.T.C. . . . . . . 465 Pine Street, Lowell

BURSAR
Wallace C. Butterfield, B. S. . . . . . 13 Sylvan Avenue, Chelmsford

EVENING SCHOOL REGISTRAR
Dorothy A. Michael . . . . 92 Hastings Street, Lowell

GENERAL INFORMATION

CALENDAR — 1952–1953

September 23, 25, 30, 1952, 7–8:30 P.M.	Registration
October 6, 1952, Monday	Classes begin
October 13, 1952, Monday	Columbus Day, Holiday
November 11, 1952, Tuesday	Armistice Day, Holiday
November 26, 27, 1952, Wednesday and Thursday	Thanksgiving Recess
December 22, 1952, Monday	Christmas Recess begins
January 5, 1953, Monday	Classes resume
February 23, 1953, Monday	Washington's Birthday, Holiday
March 12, 1953, Thursday	Evening classes end

Entrance Requirements

Entrance requirements vary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Lowell Evening Textile School, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Textile School, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering on the evenings set aside for that purpose.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules).

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

A registration fee of one dollar is required of *all* students, in addition to tuition and other charges.

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell. However, registration may be completed prior to filing this certificate with the office.

To non-residents the tuition fees are as follows:

One evening per week courses	$ 5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course that requires laboratory work must pay a laboratory fee of $10, in addition to their tuition. Those electing Machine Shop Practice must pay a laboratory fee of $5, in addition to tuition. These fees are to cover supplies and normal breakage. Any excessive breakage will be billed directly to student and must be paid before credit can be obtained for the course. No portion of these laboratory fees will be returned except as provided in the section on refunds. These laboratory fee requirements apply to *all* students registering in these courses whether they are residents or non-residents of Lowell.

Regularly enrolled day school students at Lowell Textile Institute may take evening courses without charge for tuition but must pay the one dollar registration fee and the laboratory fee where the latter is required.

All fees must be paid in full at the time of registration.

Refunds

Students dropping out of a course any time before the end of the first five weeks may obtain a refund of one-half their tuition and one-half of any laboratory fee paid, provided application for such refund is made prior to the expiration of the first five weeks. No refunds of any kind will be made after the first five weeks. The registration fee of one dollar will not be returned in any case unless the course is canceled.

Late Registration

No new registrations or course changes will be accepted for any course after the first three weeks of classes have been held in that course.

Veterans

All Lowell Evening Textile School courses are approved for study under the G. I. Bill of Rights. Those still entitled should secure a certificate of eligibility from the Veterans' Administration before registering. Books and supplies cannot be obtained without it. A letter from the Veterans' Administration, showing application for a certificate has been made, will be accepted for temporary admission to classes but must be followed by a certificate of eligibility or tuition charges will be made to the student. Veterans who have been pursuing a course of study at the Lowell Evening Textile School under its provisions may complete their program subject to V. A. regulations.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6:45 to 8:15 P.M.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

Inclement Weather

Due to difficulties in notifying in time students and instructors who reside at a distance, evening school will not be cancelled for reasons of weather at any time.

Attendance

Students must attend 70% of all classes held in a course in order to receive credit for the course. Four unexplained absences in a row will result in the student being automatically dropped from the rolls.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing of courses on following pages).

The diploma of the Lowell Evening Textile School will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for five or six years. At present diploma courses are being offered in Analytical Chemistry (six years), Textile Chemistry and Dyeing (five years), Cotton Manufacturing (six years), Woolen Manufacturing (five years) and Worsted Manufacturing (six years).

The diploma courses were initiated in 1947 and, as yet, their content is tentative and subject to change. The Institute expressly reserves the right to alter or change them in scope and content as it deems advisable. In general, however, they should not differ materially from the programs shown.

All students working toward a diploma should contact the director of evening school as soon as possible to work out a schedule of courses suitable to their objective.

COTTON DEPARTMENT

Staff

Prof. Gilbert R. Merrill, B.T.E., in charge of department
Assoc. Prof. Nathaniel E. Jones
Asst. Prof. John A. Goodwin, B.T.E., M.S.
Asst. Prof. Clarence J. Pope, B.S., M.S.
Mr. Ferrell G. Kent

		EVENINGS				
SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Cotton Yarns	111		X		X	None
Cotton Yarns	112	X		X		111
Knitting	113		X		X	None

Description of the Above Courses

111 *Cotton Yarns.* First year of cotton yarn manufacture. Topics covered include properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, carding and combing.

112 *Cotton Yarns.* Second year of cotton yarn manufacture. Topics covered include: drawing, regular and long draft roving, spinning, spooling, winding and twisting.

113 *Knitting.* A general course in the manufacture of knitted fabrics and garments. It includes yarns and yarn sizing.

Certificates

The certificate of the school will be awarded for completion of the two-year course in cotton yarns, 111 and 112. A certificate will also be awarded for the completion of 113. The old three-year cotton yarn certificate will be awarded to those qualifying under the old plan.

Diploma in Cotton Manufacturing

A diploma in cotton manufacturing will be awarded to those completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work towards an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to schedule in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

While the work load in individual years will vary, a student could expect to complete this program in six years if he attends an average of three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

The minimum requirement for the diploma in Cotton Manufacturing is a total of 720 classroom hours or an average of three evenings per week for six years.

The following courses must be taken:

Cotton Yarns 111 and 112; Weave Formations 301-A; Yarn Calculations 301-B; Cotton Design 327 and 328; Power Weaving 332; Cotton Finishing Survey 718; Textile Testing 671.

The above courses total 440 classroom hours. The remaining 280 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Power Weaving 333, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630, and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

WOOLEN AND WORSTED DEPARTMENT

Staff

Prof. James H. Kennedy, Jr., B.T.E., M.S., in charge of department
Asst. Prof. J. Frederic Burtt, B.T.E.
Asst. Prof. Michael J. Koroskys, B.S.
Mr. Russell L. Brown, Jr., B.S.
Mr. James T. Simpson

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Technology of Fibers and Yarns	202			X		None
Woolen Yarns	203	X	X			601
Top Making	204	X				601
Bradford Yarns	205			X		601
French Yarns	206	X	X			601
Textile Mechanism & Calculations	601				X	None

Description of Above Courses

202 *Technology of Fibers and Yarns.* Types of sheep and wool. Wool buying, selling, grading, sorting, scouring, stock carbonizing. Mohair, alpaca, camel hair, etc. Theory and principles of yarn making by all systems. Roller drawing, spindle drawing, porcupine. Mostly lectures, some laboratory demonstrations.

203 *Woolen Yarns.* Fiber blending, oiling, picking, woolen carding, mule and frame spinning, twisting. Reprocessed and reused fiber preparation from rags to fiber ready for carding. Mostly lectures, some laboratory demonstrations.

204 *Top Making.* Worsted carding, backwashing, open gilling, Noble combing. Specifications and analyses of standard tops, Warner Swasey Pin Drafter, Pacific Converter, Perlok System. Mostly lectures, some laboratory demonstrations.

205 *Bradford Yarns.* Worsted drawing, spinning, and twisting on English system machinery. The newer short-cut systems using the Warner Swasey Pin Drafter. Mostly lectures, some laboratory demonstrations.

206 *French Yarns.* French combing, intersecting gilling, blending, French system worsted drawing, spinning, and twisting. Mostly lectures, some laboratory demonstration.

601 *Textile Mechanism and Calculation.* A short course covering the necessary mechanism, physics and mathematics required for an understanding of textile machines. In mechanism it covers pulleys, cones, gears, levers, cranks, etc.; in physics it takes up latent heat, vaporization, relative humidity, etc.; in mathematics the topics include constants, square roots, ratio, proportion, formulas, slide rule, etc. It is designed to be taken simultaneously with the courses for which it is a prerequisite.

Certificates

The certificate of the school will be awarded for the following group of courses

Woolen Yarn Certificate— For completion of courses 601, 202, 203.

Top Making Certificate— For completion of courses 601, 202, 204.

Bradford Worsted Certificate—For completion of courses 601, 202, 204, 205

French Worsted Certificate— For completion of courses 601, 202, 204, 206

Diplomas

A diploma in woolen or worsted manufacture will be awarded to students completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening School Committee.

A student desiring to work toward an Evening School diploma should inform the Evening School Registrar as soon as possible so that he may be properly advised as to what courses to take in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

These courses will give the necessary background for the operation of a woolen or worsted mill and are designed for the student who wishes to prepare himself for the higher supervisory and executive positions.

The minimum requirement for the diploma in either woolen or worsted manufacture is a total of 720 classroom hours or an average of three evenings per week for six years.

For a diploma in woolen manufacture the following courses must be taken:

Technology of Fibers and Yarns 202, Woolen Yarns 203, Textile Mechanism and Calculations 601, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Finishing 710, and Textile Testing 671.

The above courses total 520 classroom hours. The remaining 200 hours that are required may be elected by the student from the two groups of subjects listed after the requirements for the diploma in worsted manufacture. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

For a diploma in worsted manufacture the following courses are required:

Technology of Fibers and Yarns 202, Top Making 204, Textile Mechanism and Calculations 601, Bradford Yarns 205, French Yarns 206, Weave Formations 301-A, Yarn Calculations 301-B, Woolen Design 329, Woolen and Worsted Design 330, Power Weaving 333, Woolen and Worsted Finishing 710 and Textile Testing 671.

The above courses total 600 classroom hours. The remaining 120 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group. Each course represents either 40 or 80 hours.

Textile and Engineering Courses: Knitting 113, Loom Fixing 324, Quality Control 646, Fabric Identification 331, Blue Print Reading 638, Physics 647, Mechanism 630 and other courses of a similar nature by approval of the Evening School Committee.

Business and General Courses: Foremanship 653, Industrial Relations 655, Textile Marketing, Report Writing and other courses of a similar nature by approval of the Evening School Committee. The courses in Textile Marketing and Report Writing are one evening per week courses not yet listed in the bulletin.

TEXTILE DESIGN AND WEAVING DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Assoc. Prof. Russell M. Fox
Assoc. Prof. Edward L. Golec
Assoc. Prof. John L. Merrill, B.T.E.
Asst. Prof. Martin J. Hoellrich
Mrs. Lucy R. Weinbeck, B.T.E.
Mr. Albert T. Woidzik, B.S.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Weave Formations (First 10 weeks only)	301-A			X		None
Yarn Calculations (First 10 weeks only)	301-B	X				None
Cotton Design (Second 10 weeks only)	327	X		X		301-A, 301-B
Cotton Design	328		X		X	327
Woolen Design (Second 10 weeks only)	329	X		X		301-A, 301-B
Woolen & Worsted Design	330	X		X		329
Synthetic Design (Second 10 weeks only)	325-A	X		X		301-A, 301-B
Synthetic Design	325-B		X		X	325-A
Fabric Identification	331		X			None
Power Weaving (First 10 weeks only)	332		X		X	None
Power Weaving	333	X		X		None
Loom Fixing‡	324		X		X	333

‡Loom Fixing may be taken without 333 provided sufficient work has been done by the student in industrial weaving.

Description of the Above Courses

301-A *Weave Formations.* This subject covers weaves of all types from the plain weave through fancy and figured weaves. Harness draft and chain are worked out for each weave.

301-B *Yarn Calculations.* Yarn counts for all systems, including ply and fancy yarns, are covered.

327 *Cotton Design.* Cotton cloth analysis and design are studied, beginning with plain fabrics and leading into the more fancy dobbies.

328 *Cotton Design.* The design of more elaborate cotton fabrics is taken up, such as filling backed, warp backed, ply, velvet, leno, etc.

329 *Woolen Design.* Cloth analysis and design covering blankets, bath robing, filling reversibles, extra warp and filling backs, figured effects, double cloths and plaid back.

330 *Woolen and Worsted Design.* This subject includes the more complicated fabrics some of which are chinchilla, melton, kersey as well as suitings. Costs for woolen and worsted fabrics are also covered.

325-A *Synthetic Design.* Cloth analysis and design of synthetic fabrics, including both filament and spun yarns.

325-B *Synthetic Design.* A continuation of 325-A covering the more fancy and complicated types of synthetics.

331 *Fabric Identification.* An elementary course in fabrics for those not specializing in industrial work, such as retail clerks, home economics students, etc.

332 *Power Weaving.* Warp preparation in all systems is covered as well as the Draper and Stafford automatic looms. Lecture and laboratory.

333 *Power Weaving.* More complicated looms are studied including dobby and Crompton & Knowles looms. Primarily woolen and worsted weaving. Lecture and laboratory.

324 *Loom Fixing.* The timing of all different motions in the loom and remedies for improper settings are covered. Box and harness chain planning and building are included. Lecture and laboratory.

Certificates

The cotton design certificate will be awarded for completion of 301-A, 301-B, 327, and 328.

The woolen and worsted design certificate will be awarded for completion of 301-A, 301-B, 329 and 330.

The synthetic design certificate will be awarded for the completion of 301-A, 301-B, 325-A and 325-B.

The loom fixing certificate will be awarded for the completion of 324.

The weaving certificate will be awarded for the completion of 333.

ART DEPARTMENT

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Mr. George Bordeleau
Mr. George E. Bowring
Mrs. Helen Chace
Mrs. Mary S. Kiernan
Miss Margaret Luz
Miss Ruth Munson
Miss Antoinette Neault
Miss Arlene Redmond
Mr. John F. Vaughan

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Freehand Drawing	313-A					
Section I		X		X		None
Section II			X		X	None
Pastel Drawing	334		X		X	313-A
Life Drawing	313-B	X		X		313-A
Silk Screen Printing	326		X		X	None
Show Card Design	314-A	X		X		None
Costume Design	335		X		X	None

Description of the Above Courses

313-A *Freehand Drawing.* Drawing in charcoal from casts and group arrangements of still life. Both sections cover the same material.

334 *Pastel Drawing.* Drawing in pastel from still life group arrangements.

313-B *Life Drawing.* Drawing from the live model in charcoal or in pastel. Individual and class instruction in anatomy.

326 *Silk Screen Printing.* This course covers the stencilling and printing o textiles and paper with the silk screen.

314-A *Show Card Design.* Pencil drawing of the alphabet and simple layouts c card signs executed in tempera paints.

335 *Costume Design.* How to alter the commercial garment pattern to suit th requirements of any figure.

Certificates

A one-year certificate will be awarded for the completion of any of the abo courses.

The three-year art certificate previously awarded will still be available f those who commenced their work prior to 1949–50, provided work is completed b March 12, 1953.

CHEMISTRY DEPARTMENT

Staff

Prof. Elmer E. Fickett, B.S., in charge of department
Assoc. Prof. William G. Chace, Ph.B., M.S.
Assoc. Prof. Ernest P. James, B.T.C., M.S.
Assoc. Prof. John J. McDonald, B.T.C.
Asst. Prof. Charles L. Daley, B.T.C.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Prof. Walter J. Lisien, B.T.C.
Asst. Prof. Joseph B. Masaschi. B.T.C., M.S.
Mr. Herman Brown, B.S.
Mr. Vasilis Lavrakas, B.S., M.S.
Mr. Ray E. MacAusland

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
General Chemistry	411-A		X	X	X	None
General Chemistry	411-B	X		X	X	411-A
Qualitative Analysis & Stoichiometry	411-C	X		X	X	411-B
Quantitative Analysis & Stoichiometry	413-A	X	X		X	411-C
Quantitative Analysis & Stoichiometry	413-B	X	X		X	413-A
Quantitative Analysis & Stoichiometry	413-C	X	X		X	413-B
Textile Chemistry & Dyeing	412-A	X	X		X	411-B
Textile Chemistry & Dyeing	412-B	X	X		X	412-A
Textile Chemistry & Dyeing	412-C	X	X		X	412-B
Organic Chemistry (First 10 weeks only)	417	X			X	411-B
Physical Chemistry	421		X		X	413-C
Physical Chemistry Laboratory	421-A			X		421

Description of the Above Courses

411-A *General Chemistry.* For those with no previous knowledge of chemistry. This course covers the basic principles of inorganic chemistry including the fundamental chemistry laws; the preparation, properties, and uses of metals, non-metals and related compounds; and simple chemical calculations. Lectures and laboratory. Two lectures, 7–9:30 P.M., one laboratory, 6:30–9:30 p.m., per week.

411-B *General Chemistry.* A course in elementary chemistry of college grade, open to those who have passed 411-A or a satisfactory course in high school chemistry. Emphasis is on the laws and theories of inorganic chemistry. Text—"General Chemistry" by Timin. Two lectures, 7–9:30 P.M., one laboratory, 6:30–9:30 P.M., per week.

411-C *Qualitative Analysis and Stoichiometry.* A basic course in the systematic analysis of inorganic compounds, carried out by the student in the laboratory, using semi-micro technique. Chemical calculations and the balancing of chemical equations are covered in the stoichiometry portion of the course. One lecture, 7–9 P.M., two laboratories, 6:30–9:30 P.M., per week.

413-A, 413-B, 413-C *Quantitative Analysis and Stoichiometry.* The first two years of this three-year course cover the underlying principles of gravimetric and volumetric analysis, with sufficient laboratory work to enable the student to become proficient in performing routine analysis. The third year consists in the analysis of water, soap, oils, coal and other materials of interest to the textile chemist. One lecture, 7–9 P.M.; two laboratories, 6:30–9:30 P.M., per week.

412-A, 412-B, 412-C *Textile Chemistry and Dyeing.* The first year consists of organic chemistry lectures (Course 417), the technology of fibers and an introduction to textile chemistry and dyeing. The last two years cover by lecture and laboratory the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of the fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic and union materials. The first 10 weeks of 412-A consists of three lectures per week, 7–9 P.M. The rest of the three years consists of one lecture and two laboratories per week, 7–9 P.M.

417 *Organic Chemistry.* A study of the important classes of carbon compounds and the fundamental theories of organic chemistry. Two lectures, 7–9 P.M.

421 *Physical Chemistry.* An elementary course in physical chemistry designed for the man in the laboratory or in industry. It includes a discussion of properties of gases, liquids, solids and solutions, chemical equilibrium, phase equilibrium, thermochemistry, electrochemistry and other topics according to the need of the students. Text used is "Physical Chemistry" by Bucher. This course is given alternate years with Physical Chemistry Laboratory. Two lectures per week, 7–9 P.M.

421-A *Physical Chemistry Laboratory.* Practice in the use of the methods and apparatus of physical chemistry. Includes measurement of vapor pressure, viscosity, surface tension, heat of combustion and reaction, pH by several methods and conductivity. Methods of determining molecular weight, distribution constant and calibration of apparatus are also included. Manual used is "Physico-Chemical Experiments" by Livingston. One laboratory per week, 6:30–9:30 P.M.

Diplomas

A diploma in Analytical Chemistry will be awarded for the successful completion of courses 411-A, 411-B, 411-C, 413-A, 413-B, and 413-C. This normally takes six years of three evenings per week.

A diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of courses 411-A, 411-B, 412-A, 412-B, and 412-C. This normally takes five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses and will be accepted for day school credit towards the B.S. degree of the Lowell Textile Institute.

It should be noted that course 411-B does not carry as many hours as the first year chemistry course at Lowell Textile Institute. Course 411-B is equivalent to 7 semester hours of college chemistry rather than the 9 semester hours required in day school.

Certificates

For those wishing only a general knowledge of chemical fundamentals, a certificate will be issued for the successful completion of General Chemistry 411-A and 411-B.

A one-year certificate in Qualitative Analysis will be given for the successful completion of 411-C.

A certificate is also awarded for both Physical Chemistry 421 and Physical Chemistry 421-A.

ENGLISH DEPARTMENT

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Assoc. Prof. James G. Dow, A.B.
Asst. Prof. Louis W. Stearns, B.S., M.A.
Mr. Thomas Varnum, M.A.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
English composition	511-A	X				None
English composition	511-B				X	511-A
Appreciation of Literature	512		X			None
Vocabulary Building	515		X		X	None

Description of the Above Courses

511-A *English Composition.* The fundamentals of composition including remedia English, grammar and rhetoric.

511-B *English Composition.* A course in how to write clearly and correctly. A intensive study is made of narration, description, exposition, argumenta tion and the art of letter writing.

512 *Appreciation of Literature.* A course for those wishing to enlarge the cultural background and study the principles of literary appreciation an criticism. Prose and poetry will be treated analytically with directe investigation of the various literary appeals—the intellectual, the sensor the emotional, the aesthetic, the imaginative and the philosophical.

515 *Vocabulary Building.* This course is designed to aid the student in enlarg ing his vocabulary and improve his understanding and choice of word Language roots and word evolution are also considered.

Certificates

The certificate of the school will be awarded for the successful completion 511-A and 511-B; also for 515.

BUSINESS AND INDUSTRIAL MANAGEMENT

Staff

Prof. Charles F. Edlund, S.B., Ed.M., in charge of department
Mr. Charles G. Berns, B.A., M.S.
Mr. Joseph P. Conlin, A.B.
Miss Clare T. Garrity, A.B., LL.B.
Mr. Richard W. Ivers, B.A.
Mr. Xenophon D. Michopoulos, A.B., M.A.
Dr. Paul V. McLaughlin, Ph.B., Ph.L., Ph.D.
Mr. Milton Richards
Mr. Armand J. Sorbo

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Foremanship	653	X		X		None
Industrial Relations	655	X		X		None
Principles of Salesmanship	656		X		X	None
Principles of Advertising	657		X		X	None
Contemporary World Problems	658	X		X		None
Psychology	675	X		X		None
Business Law	678		X		X	None

Description of the Above Courses

653 *Foremanship.* A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

655 *Industrial Relations.* A basic course in the underlying principles of harmonious relations between employer and employee. Some of the topics covered include: company policies and the foreman, employee morale, grievances, wages, training, collective bargaining, unions, government regulations, arbitration, etc.

656 *Principles of Salesmanship.* The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

657 *Principles of Advertising.* The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

658 *Contemporary World Problems.* A course on the present day issues of the world, viz: communism, nationalism, imperialism, socialism, secularism; etc., as they pertain to the individual's intellectual, physical and emotional life in society.

675 *Psychology.* This course covers the fundamentals of psychology with particular reference to the group relationships of the individual.

678 *Business Law.* This course covers the basic legal principles of use to people in the conduct of their every day affairs. Topics covered include contracts, mortgages, deeds, negotiable instruments, easements, conditional sales, partnerships and corporations.

ENGINEERING DEPARTMENT

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T.I., in charge of department
Assoc. Prof. Harry C. Brown, S.B.
Assoc. Prof. Maurice E. Gelinas, S.B., A.M.
Assoc. Prof. Henry E. Thomas, B.T.E.
Asst. Prof. Andrew A. Ouellette, Sc.B.
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Mr. David K. Hines
Mr. Kenneth Hird
Mr. Stuart P. Jackson
Mr. Carl A. Johnson
Mr. Forrest A. Mills
Mr. Edward N. Sabbagh
Mr. Sydney E. Stirk
Mr. Chester Whitney

Mathematics and Engineering Subjects

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Mathematics	620-A	X		X		None
Mathematics	620-B		X		X	620-A
Physics	647		X		X	None
Mechanical Drawing	613-A	X		X		None
Mechanical Drawing	613-B		X		X	613-A
Mechanical Drawing	613-C		X		X	613-B
Architectural Drawing	613-D		X		X	613-A
Architectural Drawing	613-E		X		X	613-D
Blue Print Reading	638		X		X	None
Machine Shop Practice	614-A			X	X	None
Machine Shop Practice	614-B	X	X			614-A
Strength of Materials	621		X		X	None
Steam	622	X		X		None
Mechanism	630		X		X	None
Diesel Engines	632		X		X	None
Air Conditioning	634	X		X		None
Textile Testing	639	X		X		None
Quality Control in manufacturing	646		X		X	See description
Calculus	648		X		X	Algebra and Trig.
Charts and Graphs	649	X		X		None
Textile Testing	671				X	None

Description of the Above Courses

620-A *Mathematics.* Algebra including addition, multiplication, subtraction, division, factoring and fractions.

620-B *Mathematics.* A continuation of 620-A. Some of the topics treated are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigonometry.

647 *Physics.* An elementary course in physics on the high school level, designed primarily for those lacking sufficient high school credits to work toward a diploma. Lecture and demonstration.

613-A *Mechanical Drawing.* The fundamentals of drawing. Use of instruments, geometric construction, lettering, orthographic projection, auxiliary views, sectional views and dimensioning.

613-B *Mechanical Drawing.* Second year for those whose interest is primarily in machine drawing. Engineering sketching, screw threads and fasteners, intersections and developments of surfaces, pictorial drawing.

613-C *Mechanical Drawing.* Third year. Sheet metal drawing, detail and assembly drawing, blueprinting from pencil and ink originals. Computation of areas, volumes and weights.

613-D *Architectural Drawing.* A continuation of 613-A for those whose main interest is in architectural drawing. The course will revolve about the design of a small house and will include a plot plan, floor plans, elevations, sections and architectural details.

613-E *Architectural Drawing.* Third year. The set of house plans begun in 613-D will be completed with drawings of heating, plumbing and electrical systems in orthographic and isometric styles. Cost estimates and a perspective of the house will complete the course.

638 *Blue Print Reading.* A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc., in order to read and understand blue prints.

614-A, 614-B *Machine Shop Practice.* A two-year course in metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, heat treatment, forging, use of special tools, etc.

621 *Strength of Materials.* A basic course in strength of materials covering such topics as tension, compression, shear, cast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, boiler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

622 *Steam.* Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

630 *Mechanism.* A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

632 *Diesel Engines.* An elementary study of diesel engines, their operation, and maintenance. Topics covered include types of diesels, fuel oils, fuel injection systems, combustion, cooling systems, application, maintenance, etc. Lectures and assignments.

634 *Air Conditioning.* A course in the principles of air conditioning covering the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

639 *Textile Testing.* A study of the methods used in the determination of the physical properties of textiles and the interpretation of test data. The topics covered include a consideration of textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, tearing strength, thickness, bursting strength, crimp, twist, regain, etc. Lectures and laboratory.

646 *Quality Control in Manufacturing.* This course deals with the quality problem in manufacturing and approaches it through the use of statistical quality control. How to determine the true accuracy of a machine or process, how to distinguish between normal and abnormal variations in any process and how to use small sample plans for inspection are examples of topics covered. Prerequisite: Approval of the instructor. Normally requires two years of college or industrial experience. Statistics is not required. Limited to 25.

648 *Calculus.* The fundamental principles of differential and integral calculus. The first half covers differential calculus with the necessary analytical geometry and the second half covers integral calculus. This course is a college credit course and is accepted for credit toward the B.S. degree of Lowell Textile Institute. Only students with a good background and ability in mathematics should attempt this course.

649 *Charts and Graphs.* This course covers instruction and practice in the construction and drawing of charts, graphs, sketches, posters, etc., made with ordinary office equipment on graph paper, ditto master sheets, stencils, etc.

671 *Textile Testing.* A short course in textile testing, primarily designed for students working toward a diploma in the yarn manufacturing courses. The emphasis is on understanding and interpreting the results of the testing department or working with them rather than developing skill in the actual testing program.

Certificates

The certificate of the school is awarded for the completion of the following courses or groups of courses described above: 620-A and 620-B; 647; 613-A, 613-B, 613-C; 613-A, 613-D, 613-E; 638; 614-A and 614-B; 621; 622; 630; 632; 634; 639; 646; 648; and 649.

ELECTRICITY

EVENINGS

JBJECT and NUMBER		Mon.	Tues.	Wed.	Thur.	PREREQUISITE
lectrical Circuits	644	X		X		Algebra
. C. Machinery	636-A		X		X	644
. C. Machinery	636-B		X		X	644
undamentals of Electronics	640		X		X	644
ıdustrial Electronics	641		X		X	640
rinciples of Radio	642	X		X		640

Description of the Above Courses

ı4 *Electrical Circuits.* A basic course in direct and alternating current circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

ı6-A *D. C. Machinery.* The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D. C. equipment.

ı6-B *A. C. Machinery.* Topics include application of instruments to A. C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

ı0 *The Fundamentals of Electronics.* Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

ı1 *Industrial Electronics.* The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

ı2 *Principles of Radio.* Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

Certificate

The certificate of the school will be awarded for the successful completion of ıy of the above six courses. Those who commenced work on the old three-year rtificate prior to 1950–1951 will still be awarded three-year certificates in Elecıcal Machinery (644, 636-A and 636-B), Industrial Electronics (644, 640 and 641) ıd Radio (644, 640 and 642), providing work is completed by March 12, 1953.

FINISHING DEPARTMENT

Staff

Assoc. Prof. Winford S. Nowell, B.M.E.
Assoc. Prof. John J. McDonald, B.T.C.

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
Woolen & Worsted Finishing	710	X		X		None
Cotton & Synthetic Finishing	711		X		X	None
Cotton Finishing Survey	718			X		None

Description of Above Courses

710 The finishing of both woolen and worsted cloths. Some of the topic covered are burling, mending, fulling, washing, speck dyeing, carbonizing gigging, napping, steaming, brushing, shearing and pressing. Lectures anc some laboratory demonstration.

711 The finishing of cotton and synthetic fabrics. Some of the topics covere are inspecting, trimming, shearing, singeing, washing, napping, mangles starching, dryers, stretchers, callenders, folding and marking. Lecture and some laboratory demonstration.

718 A summary of the important features of Course 711, designed for diplom students in cotton yarn manufacture and others who would like a back ground in the finishing process.

Certificates

The certificate of the school will be awarded for the successful completion c either Course 710 or 711.

DEPARTMENT OF PAPER ENGINEERING

Staff

:of. John Lewis, B.S., M.S. in charge of department
[r. Alfred K. Hobbs, B.S., M.S.

EVENINGS

JBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thur.*	*PREREQUISITE*
ıper Technology	801		X			None
ıdvanced Paper Technology	802				X	801

Description of the Above Courses

)1 *Paper Technology.* This course covers coarse papers, fine papers, paper testing and the printing processes as applied to paper. If the class is not too large, there will be some laboratory work in paper testing. It is designed to acquaint the user or dealer in paper with the technical background of the industry.

)2 *Advanced Paper Technology.* This course goes into the manufacture and use of paper in greater detail than 801. It may be taken without completing 801 providing the instructor approves.

Certificate

The certificate of the school will be awarded for the successful completion of)2.

Diploma

It is planned to offer a diploma course in paper technology in the near future. he first four years of the required six years work will be in basic chemistry and will ›nsist of General Chemistry 411-A and 411-B, Qualitative Analysis 411-C and a ›ecial one-year course in Quantitative Analysis; the fifth year will cover the principles of paper manufacture and the sixth year will be a laboratory course in paper sting and technology. Those wishing to start on the chemical portion of this ploma course now, will receive full credit towards the diploma for the above emical courses.

DEPARTMENT OF LEATHER ENGINEERING

Staff

Prof. Albert E. Chouinard, B.S., M.S., Ph.D., in charge of department
Mr. Alfred H. Mueller

EVENINGS

SUBJECT and NUMBER		*Mon.*	*Tues.*	*Wed.*	*Thurs.*	*PREREQUISITE*
Technology of Leather	418		X		X	Chemistry

Description of the Above Course

418 *Technology of Leather.* An elementary course covering the preparation of leather of various types and finishes. The chemistry and technology of various tannery processes are covered so as to be understandable to a student with a fair knowledge of chemistry. Lectures only. 7–9 P.M.

Diploma

It is planned to offer a six-year diploma course in Leather Engineering in the near future. The first three to four years will consist of basic chemistry courses. Students interested in such a program may start with General Chemistry 411-A and 411-B and Qualitative Analysis 411-C. These courses will definitely count towards the leather diploma.

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BULLETIN

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SPECTROSCOPIC ANALYSIS
ITS APPLICATION IN THE TEXTILE INDUSTRY

by

ADOLPH KATZ*

Introduction:

The science of spectroscopy has its origins in an observation by Sir Isaac Newton 1666). He found that by passing a beam of sunlight through a prism in a dark om an ordered arrangement of colors appeared on the wall. However, it was not til nearly 200 years later (1859) that Kirchhoff and Bunsen combined a narrow slit light with Newton's prism to produce the first spectroscope — an instrument to parate various electromagnetic radiations ranging from infra-red to the ultra-olet. Today, spectroscopy has developed to a point where it is no longer the ex-usive field of the research scientist, but is rapidly becoming an integral part of erations and production in many industries. Every day, advances in spectro-opic technique and equipment are taking place, and further applications of the ectroscope to problems in science and industry are discovered. In view of these ctors, it shall be the purpose of this paper first, to present some broad fundamental ncepts of spectrum analysis; secondly, to discuss spectroscopic equipment, with rticular reference to the spectrographic laboratories at Lowell Textile Institute; d finally to illustrate applications of spectroscopy in both science and industry — th specific consideration for uses in the textile industry.

The atom consists essentially of a nucleus surrounded by electromagnetic fields different energy levels. When the atom is excited by an external source, such as flame, the electrons producing the electromagnetic field are forced away from the gh energy levels near the nucleus to outer orbits having a lower energy level. This ange in energy level produces a characteristic energy radiation from the atom ich takes the form of light. The relationship between the change in energy level d the resulting frequency of the light emitted may be expressed by the formula

$$E_2 - E_1 = h\nu$$

which E_2 is the energy in the higher electron state, E_1 is the energy in the lower ectron state, he is Planck's constant, and ν the frequency of the light emitted. It n be shown that only certain discrete energy level changes may take place within given atom, and these changes result in radiations which are characteristic of the ement. These radiations are arranged in an ordered manner by wave length[1] to oduce the spectrum of that particular element.

Since electromagnetic radiations have wave lengths varying from millionths of a illimeter to millions of meters, and since there are different methods of analysis r each wave-length range, we shall limit our discussion to a specific range. Hence, shall deal essentially with the spectrum from 2000 Angstroms[2] to 20,000 Ang-roms.[3]

Several tables and charts have been prepared for the spectrum of nearly 90 ele-ents giving wave-length measurements in some cases as closely as 0.001A. These bles serve as a reference to identify the presence of elements in a substance of ich a spectrogram has been made.

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*Assistant Professor in Textile Engineering, Lowell Textile Institute.

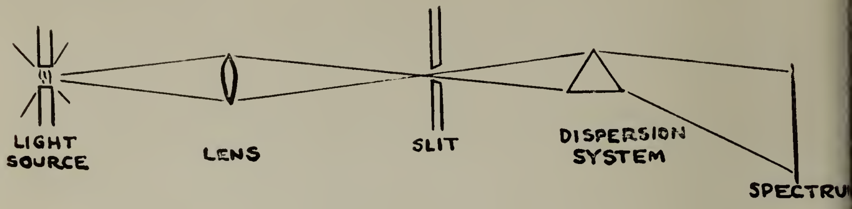
[1] For all practical purposes, the relationship between wave length and frequency is $\lambda = c/\nu$, where s the wave length of the radiation and c is the speed of light and is equal to 3 x 10^{10} cm per second.

[2] The Angstrom is equivalent to 10^{-8}, cm.

[3] The radiation with wave length greater than 20,000A is the infra-red region of the spectrum and re-ires heat-sensitive devices for measurement. The radiation with wave length less than 2000A is in the ultra-violet region of the spectrum and the use of special gas-filled or evacuated equipment is required.

THE SPECTROGRAPH

A spectrograph is a device used to produce a photographic record of a spectru[m]. It consists of 4 essential components: Light source, slit, light dispersion system, a[nd] a photographic plate.



SCHEMATIC DIAGRAM OF SPECTROSCOPE LIGHT SYSTEM

The light source may be either an arc, spark, flame, or a gas discharge, dependi[ng] upon the material to be analyzed. Probably the most popular method today is t[he] DC arc. The slit must be a very carefully made unit inasmuch as the photogra[ph] of the spectrum is actually a reproduction of the slit. The dispersion system m[ay] be either a prism or a diffraction grating. The choice of dispersion system is usua[lly] governed by the desired range of spectrum required and the funds available for t[he] purchase of equipment. The grating has these distinct advantages over the pris[m]: a dispersion independent of wave length, and the ability to operate effectively o[ver] a wide range of wave lengths. A large supply of photographic plates and films [is] commercially available with emulsions sensitized for specific wave-length ranges.

Qualitative Analysis

The qualitative analysis of a sample may take the form of one of two problem[s]: (1) a search for a definite element, and (2) identification of unknown elements pr[es]ent in the sample. In either case, a spectrum photograph is taken of the unkno[wn] sample using one of the light sources mentioned above. For measurement purpo[ses] a calibrated scale or spectrum of a known element such as iron should be pho[to]graphed adjacent to the spectrum of the sample.

In the first case, it is only necessary to identify three persistent lines of the e[le]ment to prove its presence. This can be done by comparison of the sample spectr[um] with a standard spectrum of the element sought. In the event that such a stand[ard] is not available it is only necessary to calibrate a scale adjacent to the spectrum [in] wave length, and then search for lines at the wave lengths specified by tables [for] the element.

To identify unknown elements a more thorough procedure is necessary, since [all] spectrum lines must be identified. The wave lengths of the lines can be determi[ned] from a scale or comparison spectrum, and by reference to wave-length tables [the] possible elements associated with the line may be tabulated. Identification of [the] wave length of a line may be accurately determined by using a measuring dev[ice] such as a micrometer comparator (essentially a traveling microscope). Many li[nes] may be rapidly eliminated if a strong line of an element is located, and then the [re]maining lines of the element are found by comparison to the standard spectrun[m of] the pure element.[2]

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[1] Persistant lines — the most intense spectral lines which appear even in the spectrum of a very dil[ute] element.

[2] Standard pure spectrographic samples are available from many commercial laboratory supplies[,] Bureau of Standards, and some manufacturers of spectrographic equipment.

ectrographic laboratory at Lowell Textile Institute showing JACO microphotometer the rear of the room. The control panel and source housing of the Baird 3 meter grat- g spectrograph can be seen on the right. In the foreground are AC and DC arc sources.

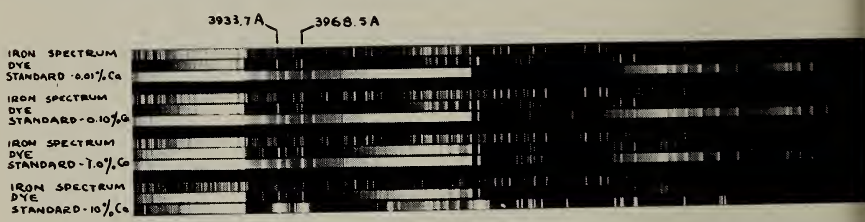
well Textile Institute spectrographic laboratory with the specimen preparation on the nt. On the bench are a Gaertner Microcomparator, electrode cutter, and viewing box h a binocular microscope. The control panel of the AC arc source can be seen in the ter of the photo.

Quantitative Analysis

Quantitative analysis by spectroscopic methods is made possible by the fact that the quantity of radiation emitted by excited atoms is dependent, among other things, upon the number of atoms present. By eliminating, or balancing out the other factors which affect the quantity of radiation, it is possible to use the radiation emitted from the sample to effect the blackening (or density) of the line on a photographic plate and serve as an indicator of the amount of the element present in a sample.

There are several techniques for spectroscopic quantitative analysis, but they are basically variations in the methods of comparing the density of a line in the spectrum of the sample to the density of a line of a standard spectrum in which the concentration of the element present is known. Some of the most common methods for comparison of radiation emitted from an excited atom are the logarithmic sector method, densitometer method, and photoelectric comparison. It will suffice to describe only the basic technique, since the methods of comparison are essentially instrumental refinements and variations of the basic technique.

Every sample for analysis may be considered to consist of 2 parts: (1) a matrix consisting of one or more elements which form the major portion of the sample, and (2) one or more constituents comprising only a small part of the total sample. The matrix can influence the conditions in the light source, whereas the minor elements are present in such small amounts that they have no noticeable effect upon the source. Hence, in preparing a specimen to be used as a standard, the matrix of the standard must be similar to the sample to be analyzed. As an illustration let us take a sample of a dye in which we wish to determine the amount of calcium present.



A positive of a plate taken in the analysis for the concentration of calcium present in a dye.[1] Note the increase in intensity of the calcium lines (3933.7A and 3968.5A) of the spectrum of the standard sample as the concentration of calcium is increased from 0.01% to 10%. From this plate it is possible to estimate the concentration of calcium in the dye as lying between the limits of 0.01% and 0.1%.

First, it is necessary to prepare a series of identical dye samples in which the amount of calcium can be controlled. For convenience we can first prepare standards containing 1%, 0.1%, 0.01%, and 0.001% of calcium. These standards are then burned in a manner that duplicates the burning of the unknown sample as closely as possible. From the resulting spectrogram, we can find a line of calcium (3933.7A) in the unknown sample whose density is within the range of densities of a similar line on the standard's spectrum. It can be seen that the density of the unknown calcium line falls between the densities of 0.01% and 0.10% of the standard's spectrum. The process can then be repeated with standards prepared in several steps, this time from 0.01% to 0.10%, and another match made. This could be continued until the desired precision of measurement is obtained. With experience, this technique can be carried out very rapidly. With commercial spectrographic equipment now available, it is possible to obtain accurate quantitative analysis for as many as 30 different elements present in a sample in less than 5 minutes!

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[1] In relation to a Master's thesis by J. M. Greenberg at Lowell Textile Institute in 1952 on the purification of DuPont Metanil Yellow Conc-Color Index No. 138 by ion exchange. It was necessary to determine the amount of calcium remaining in the dye when the dye was returned to a sodium salt from a calcium salt.

pectrographic Laboratory

The extent of equipping a spectrographic laboratory depends upon the type of ork to be conducted and the funds available. Consideration must also be given › several other factors.

(*a*) Will the analyses be of a routine nature?
(*b*) Will quantitative as well as qualitative information be necessary?
(*c*) What is the desired precision of measurement to be obtained?
(*d*) What are the types of materials to be encountered for analysis?
(*e*) What is the time allowable for analysis?

asic equipment would consist of a spectrograph, light source, photographic dark›om, a projector or comparator, wave-length tables and charts, and if quantitative ıta is desired a densitometer should be added. The cost of a spectrographic lab·atory would range from about $100 for rough qualitative work in the visual range the spectrum to approximately $15,000 for a good grating spectrograph and suitɔle accessory equipment. The facilities at the Lowell Textile Institute laboratory ›nsist of the following:

(1) Baird 3 meter grating spectrograph[1]
Range: 1800–21,000 Angstroms
Resolution: 5.5 Angstroms per millimeter in the first order
Control: electric, automatic
Slits: 25, 50, 75, 100 micron widths
(2) JACO Comparator Microphotometer (Non-Recording)[2]
Magnification: 10X
Slit: Adjustable continuously from 0–35 Microns
Reproducibility: $\pm\frac{1}{2}\%$ over a transmission range of 20% to 70%
Speed: 3–5 lines per minute
(3) Comparator: Gaertner Wave-Length Comparator
Travel: 10 cm.
Accuracy: 0.001 mm.
(4) Viewing Box
(5) Electrode Cutter
(6) Photographic darkroom completely equipped

APPLICATIONS

The greatest advantage of spectroscopic methods is in qualitative and quanti-tive analysis of samples for elements in concentrations of 1% or less. In the case certain elements it is possible by means of a DC arc source to detect the presence that element in concentrations as small as 0.01 parts per million. Some of the ements which are particularly sensitive to analysis are lithium, sodium, mag›sium, copper, calcium, silver, gold, potassium, chromium, molybdenum, strontium, ıd barium. The spectrograph is superior to ordinary wet chemical methods of ıalysis since analyses can be obtained rapidly, and photographic techniques used provide a permanent record of the analysis for future reference and comparison. he spectrographic method is particularly valuable where only small quantities ı the order of milligrams) are available for analysis. By a single spectrum of the mple it is possible to determine all the elements that are present. In chemical ethods, however, it is quite possible to lose one element while searching for another. The spectroscope has found wide application in such diversified fields as medicine, iminology, and the steel industry. It will suffice to give just a few illustrations of ›plications of the spectrograph:

1. Determination of traces of lead and other elements in human tissues in relation to studies of cancer.

[1] Data from Baird Associates Bulletin XXXII.
[2] Data from Jarrell-Ash Co. Catalog MII-51.

2. Quality control — analysis of manufactured organic materials for impurities.
3. Study of trace elements in plants and leaves in order to investigate the possible relationship between these elements and the growth and character of the plant.
4. Positive identification of contents of such items as hair, soil, clothing, etc., to serve as court evidence in criminal proceedings.
5. Rapid analysis of alloying metals and impurities in molten steel to serve as an indicator and control of the type and quality of the steel before pouring.
6. Clinical diagnosis of diseases by analysis of human organs for trace diagnosis (Here is an excellent example of where only minute samples are available for analysis.)

In textiles, the use of spectroscopy dates back before 1927, and is even more valuable in the industry today. In the manufacture of various dyes, the spectrograph is used as a control for the presence of metallic impurities which would affect the dyeing process. A similar use is in the analysis of the water used for textile processing, where again impurities would affect the finish of the fabric. In the rubberizing of fabrics, the presence of copper and manganese will result in a brittle finish. By use of the spectroscope it is easy to locate such impurities and eliminate them before the rubberizing process begins.

The spectroscope offers splendid possibilities for analysis in conjunction with applied research in textiles. In cotton growing it would be conceivable to analyze the cotton plant for the presence of trace elements and then to determine if there is any relationship between the trace element and the growth of the plant and the quality of the cotton. Precise quantitative analyses can be made of minor constituents of both natural and synthetic fibre in an effort to determine relationship between these elements and such characteristics as strength, spinnability, static electricity, and other properties of importance in the manufacture of textiles.

SUMMARY

It has been the purpose of this paper to present briefly the underlying principles of spectroscopy and the fundamental methods used for qualitative and quantitative analysis.

The spectrograph and auxiliary equipment have been discussed to give an insight into the apparatus necessary for the installation of a spectrographic laboratory.

Typical applications of spectroscopy in textiles as well as other fields have been presented to give the reader some idea of the possibilities of spectroscopy.

The spectrographic laboratory facilities at Lowell Textile Institute are continually being expanded for both industrial analysis and fundamental research. They are open for inspection to anyone desiring further information on spectroscopy and spectrographic equipment.

BIBLIOGRAPHY

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BULLETIN

OF THE

Lowell Textile Institute

Catalogue Issue for

1953-1954 Session

Textile and Colonial Ave. Lowell, Massachusetts

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2. Kitson Hall
3. Falmouth Street Building
4. Pasteur Hall
5. Smith Hall—residence hall
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Lowell Textile Institute

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The Institute reserves the right to make changes in the regulations, courses, and charges announced in this Bulletin.

INSTITUTE CALENDAR

FOR

1953

September 14, Monday, 9 A.M.	Freshman Orientation
September 21, Monday, 9 A.M.	Registration of all students other than freshmen.
September 22, Tuesday, 8 A.M.	All classes begin.
October 2, Friday	Last day to register for new classes.
October 12, Monday	Columbus Day. Institute closed.
October 16, Friday	Last day to drop classes without penalty.
November 11, Wednesday	Armistice Day. Institute closed.
November 25, Wednesday, 12 Noon to November 30, Monday, 8 A.M.	Thanksgiving recess.
December 18, Friday, 5 P.M. to January 4, Monday, 8 A.M.	Christmas recess.

1954

January 4, Monday, 8 A.M.	Classes resume.
January 25, Monday, 8 A.M. to February 3, Wednesday, 5 P.M.	First semester examinations.
February 8, Monday, 9 A.M.	Registration for second semester.
February 9, Tuesday, 8 A.M.	All classes begin.
February 19, Friday	Last day to register for new classes.
February 22, Monday	Washington's Birthday. Institute closed.
March 5, Friday	Last day to drop classes without penalty.
April 14, Wednesday, 5 P.M. to April 21, Wednesday, 8 A.M.	Easter recess.
May 31, Monday	Memorial Day. Institute closed.
May 24, Monday, 8 A.M. to June 2, Wednesday, 5 P.M.	Second semester examinations.
June 7, Monday	Commencement exercises.

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WILLIAM G. CHACE, Ph.B. (Brown University), M.S. (Lowell Textile Institute), Box 250, Westford.
ERNEST P. JAMES, B.T.C., M.S. (Lowell Textile Institute), 11 Beech St., North Chemsford.
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CHARLES L. DALEY, B.T.C. (Lowell Textile Institute), 465 Pine St., Lowell.

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In recognition of the unique research opportunities afforded to the textile industry by virtue of the equipment and staff available at Lowell Textile Institute, the Institute has been authorized by the Massachusetts State Legislature to conduct research, development, and consulting programs under contract with responsible agencies. This activity has the effect of permitting staff members access to new and significant developments in the textile and allied industries and materially assists in keeping the teaching programs current and dynamic.

In order to facilitate the research work of the Institute, the Massachusetts State Legislature, in November 1950, authorized the establishment of the Lowell Textile Institute Research Foundation.

This Research Foundation provides the necessary mechanism whereby all of the research work of the Institute is brought under one coordinating office headed by the Executive Director. As in the past, however, the faculty of the Institute does the greater part of the research work. This plan has been proven through years of experience to be very beneficial to both the Institute and the client.

The Foundation has the use of the Institute's laboratory and research facilities. This arrangement places at its disposal the regular laboratories in chemistry, physics, and engineering; the completely equipped laboratories in all phases of textile, paper or leather processing; the laboratories for textile dyeing and finishing; and the testing laboratories for textiles, paper and leather. In addition, the Institute has many unusual research facilities. These include a completely equipped laboratory for work with radio-active materials, an Instron tester, x-ray diffraction equipment, a large spectograph, recording spectrophotometers, a pulse-propagation meter, a completely equipped laboratory for microscopic work including a phase microscope and an electron microscope.

Project Activity

The Lowell Textile Institute Research Foundation is now engaged in several research and development programs for the Air Force. Two of these involve dyeing studies in an effort to improve light-fastness properties of fabrics utilized by this government agency. A third project deals with the evaluation of the energy absorption capacity, under compression, of shock absorbing materials intended for use in parachute drop kits. An impact tester designed for measuring the characteristics of these materials under high rates of loading is now under construction. Yet another project involves the improvement of the thermo-resistance of nylon parachute fabrics for high-altitude usage.

An economic survey of the actual and potential markets for wool scouring by-products is now under progress under the sponsorship of the U. S. Dept. of Agriculture, Bureau of Agricultural Economics. A technical evaluation of wool scouring and waste recovery has recently been completed by the Foundation under a grant by the U. S. Dept. of Public Health.

In addition to the above, several programs of research under industrial-sponsorship are now in progress at Lowell including a study of the influence of the surface coefficients of friction of cotton fibers on processing conditions, the design and manufacture of optimum constructions for abrasive backings, and the processing evaluation of new experimental fibers.

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Dorothy Lamoureux, 445 Merrimack Street, Lowell, *Laboratory Technician.*

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Edwin C. Sherburne, B.S. (Lowell Textile Institute), Coburn Road, Tyngsboro, *Graduate Fellow.*

James Wang, B.S., M.S. (Lowell Textile Institute), 31 Waverly Avenue, Lowell, *Research Associate.*

ALUMNI ASSOCIATION

The membership of the Alumni Association of the Institute is composed of graduates of the day courses and is open to any non-graduate who has satisfactorily completed at least one year of the day curriculum. Membership also includes Associate and Honorary classifications.

The Association holds its annual business meeting and banquet in the spring of each year.

Communications should be addressed to Prof. A. Edwin Wells, Executive Secretary, Alumni Office, Lowell Textile Institute.

OFFICERS AND DIRECTORS FOR THE YEAR 1952-1953

Philip E. MacLean, '47, *President*

Kenneth B. Cook, '13, *First Vice-President*

Levon M. Yacubian, '26, *Second Vice President*

A. Edwin Wells, '20, *Executive Secretary, Clerk and Treasurer*

Ernest P. James, '42, *Assistant Secretary*

ALUMNI FUND COUNCIL

Evan H. Fairbanks, '35, *Chairman*
Philip E. MacLean, '47, *Chairman, Fund Committee*

BOARD OF DIRECTORS

Term Ending 1953

Philip E. MacLean, '47
James A. Irvine, '17
Gerald F. Quigley, '31
Robert C. Wilkie, '34
Milton Hindle, '25

Term Ending 1954

Harold W. Leitch, '14
Charles H. Forsaith, '20
Kenneth B. Cook, '13
William T. Dewey, '34
Raymond W. McKittrick, '28

Term Ending 1955

G. Harry Gwinnell, '25
David A. Travis, '24
Levon M. Yacubian, '26
Philip E. Mason, '26
Robert M. Bent, Jr., '46

Advisories

Martin J. Lydon, *President, Lowell Textile Institute*
Samuel Pinanski, 12, *Chairman, Trustees, Lowell Textile Institute*
Ralph K. Hubbard, '11, *Past President, Lowell Textile Institute Alumni Association*

LOWELL TEXTILE INSTITUTE

The Lowell Textile Institute, formerly known as the Lowell Textile School, was incorporated under the laws of Massachusetts in 1895 and functioned as a private institution and a recipient of state aid for several years following its inception. Its formal opening took place on January 30, 1897 with a teaching staff of thirteen and a student body of thirty-three. The school occupied rented quarters in downtown Lowell until the completion of Southwick Hall, the first of its present buildings, in January, 1903. The property of the school was transferred to the Commonwealth of Massachusetts in July, 1918 and since that time control and management have been vested in a Board of Trustees appointed by the Governor.

The name of the school was changed to Lowell Textile Institute in 1928 in order to indicate more clearly the standing of the institution.

In December, 1948, the Institute was accepted to full membership in the Senior College Division of the New England Association of Colleges and Secondary Schools. The United States Department of Education and the Armed Forces consider such membership equivalent to regional accreditation. The Engineers' Council for Professional Development extends full accreditation to the curricula in Textile Engineering.

According to the original act authorizing its establishment, the Institute was founded "for the purpose of instruction in the theory and practical art of textiles and kindred branches of the industry". Throughout the years it has steadily broadened its scope both in physical equipment and educational service, keeping pace with the progress of the industry it serves. In a continuing effort to render the greatest possible educational opportunities to the Commonwealth, the program of the Institute was broadened, in September, 1950, to include curricula in Paper Engineering and Leather Engineering.

During the early years of the Institute's existence, in keeping with its initial educational objectives, no degrees were offered but diplomas were given for the completion of specified courses of study. However, in 1913, the degrees of Bachelor of Textile Engineering (B.T.E.) and Bachelor of Textile Chemistry (B.T.C) were conferred on those students who completed four years' study in one of the several curricula offered at the Institute. All vocational work is offered in the Lowell Evening Textile School program which is described in another bulletin.

Lowell Textile Institute now confers the degree of Bachelor of Science upon successful completion of the requirements of one of the several curricula listed in this catalogue. It also confers the Master of Science degree for successful completion of graduate studies in Textile Chemistry, Textile Engineering, Paper Engineering, and Leather Engineering, and has limited offerings in Textile Manufacturing and Synthetic Textiles.

The curricula of the Institute are under constant study. Revisions are made whenever it is clearly indicated that changes are necessary in order for the Institute to fulfill its traditional purpose of service to the industries. In choosing the present curricula, the Administration and Faculty have been aware of their obligation to prepare students for entrance into the industry of their choice whether it be the Textile, Paper, Leather, or similar fields. In addition to fundamental courses in the physical sciences and engineering, considerable work in practical industrial applications has been included. Broadening yet practical courses in English and the social sciences have been woven into all curricula in a conscious effort to produce graduates who are not only well trained technically but are prepared to

take their places in society. It has been recognized in the preparation of these curricula that no college program can adequately produce a specialist. The aim is to provide the student with a solid fundamental background and to predispose him to obtain additional and specialized education after graduation.

COEDUCATIONAL

Within the last few years, the possibilities for women in certain branches of the textile field have become recognized, and it is believed that in the future the positions open to them will become more and more numerous. Although all classes are open to women, the subject of textile design is especially interesting to some, since it offers a broad training that prepares for many lines of activity. For those who wish to specialize in structural and decorative textile designing, the Textile Design Course III is recommended. Some are interested in textile chemistry and pursue the Chemistry Course. These courses lead to positions either in mill offices or in some commercial lines which are desirable and offer congenial work.

LOCATION

Lowell Textile Institute is located in Lowell, a city of 100,000, long famous as a great center of the textile industry. The campus occupies a commanding site on the west bank of the Merrimack River, overlooking the rapids of Pawtucket Falls, which furnished the first extensive use of water power in America for the operation of power looms. The 15 acres which constitute the main campus were given by Frederick Fanning Ayer, Esquire, and the Proprietors of the Locks and Canals on the Merrimack River.

BUILDINGS

Southwick Hall—The offices of the President, Dean of the Faculty, Dean of Students, Registrar, Admissions, the Business Officer, and the Department of Engineering, are located in the north wing; the Department of Chemistry, Dyeing and Finishing, in the south wing. The central section, which houses the gymnasium and the Assembly Hall, is pierced by an archway which gives access to the central courtyard. Erected in 1902 by contributions of the Commonwealth of Massachusetts and Mr. Frederick Fanning Ayer as a memorial to Royal Southwick, a leading textile manufacturer, a public man of earlier days and a maternal ancestor of Mr. Ayer.

Kitson Hall—The Department of Cotton Yarns and Knitting, the Mechanical and Electrical Engineering laboratories, and the Machine Laboratory. Erected in 1902 as a memorial to Richard Kitson, founder of the Kitson Machine Company of Lowell and a leading manufacturer of the city, by gifts from Charlotte P. Kitson and Emma K. Stott, his daughters, and the Kitson Machine Company.

Falmouth Street Building—Departments of Design and Power Weaving, Woolen and Worsted Yarn, Synthetic Textiles, and the picker section of the Cotton Yarn Department. Erected in 1903 as a one-story building, and finally enlarged to its present capacity in 1907 by the Commonwealth of Massachusetts.

Louis Pasteur Hall—Offices of the Wool Department, Cotton Finishing Laboratory, research laboratories in Chemistry, Textile Coloring, and Finishing, laboratories, classrooms, and lecture rooms. Originally constructed as a one-story building, it was subsequently enlarged to three stories, in 1937, by the Commonwealth of Massachusetts.

Paper and Leather Building—Departments of Paper Engineering and Leather Engineering, with extensive floor space allotted to the Physics Section. Com-

pleted in 1952, through funds appropriated by the Commonwealth of Massachusetts.

Alumni Memorial Library—This building was named and dedicated in honor of Lowell Textile men and women who served in World Wars I and II and the Korean conflict. It has a book stack capacity of 80,000 volumes, with reading room capacity for 150 students. In addition to the basic library which emphasizes textiles, chemistry, and engineering, it contains the Edgar Francis Billings Literature Collection. The library is an official depository for U. S. Government Publications, and subscribes to all scientific journals in textile and allied fields. The building houses all library activities, a microfilm and microcard room, alumni offices, faculty studies, complete office facilities for student activities, and the campus mail room. Completed in 1951, the library was erected through contributions by the Alumni and many firms and individuals in the textile and related industries.

Smith Hall—Men's residence hall with accommodations for 112 students and a faculty proctor, a dispensary for students, and quarters for the resident nurse. The college cafeteria, in the basement, caters to all students and the faculty. Smith Hall is dedicated in honor of James T. Smith, pioneer educator in the textile field, the individual primarily responsible for the organization of Lowell Textile Institute. Erected in 1948 by the Lowell Textile Institute Building Association.

Eames Hall—Men's residence hall with accommodations for 112 students, plus an apartment for a married faculty proctor. Also has a Student Lounge and Snack Bar, fully equipped for lounging and recreation. It is dedicated in honor of Charles H. Eames, President of the Institute, 1905-1945. Erected in 1949 by the Lowell Textile Institute Building Association.

Administration-Auditorium Building—This building is now under construction and scheduled for completion in the fall of 1953. The Administration area will provide space for the offices of the President, Dean of the Faculty, Dean of Students, Registrar, Admissions, Guidance, Graduate Division and Business Offices. The Auditorium area will provide an Auditorium for academic convocations, dramatics, social functions, and other campus activities. The basement will provide student locker rooms, and the AF-ROTC offices and rooms.

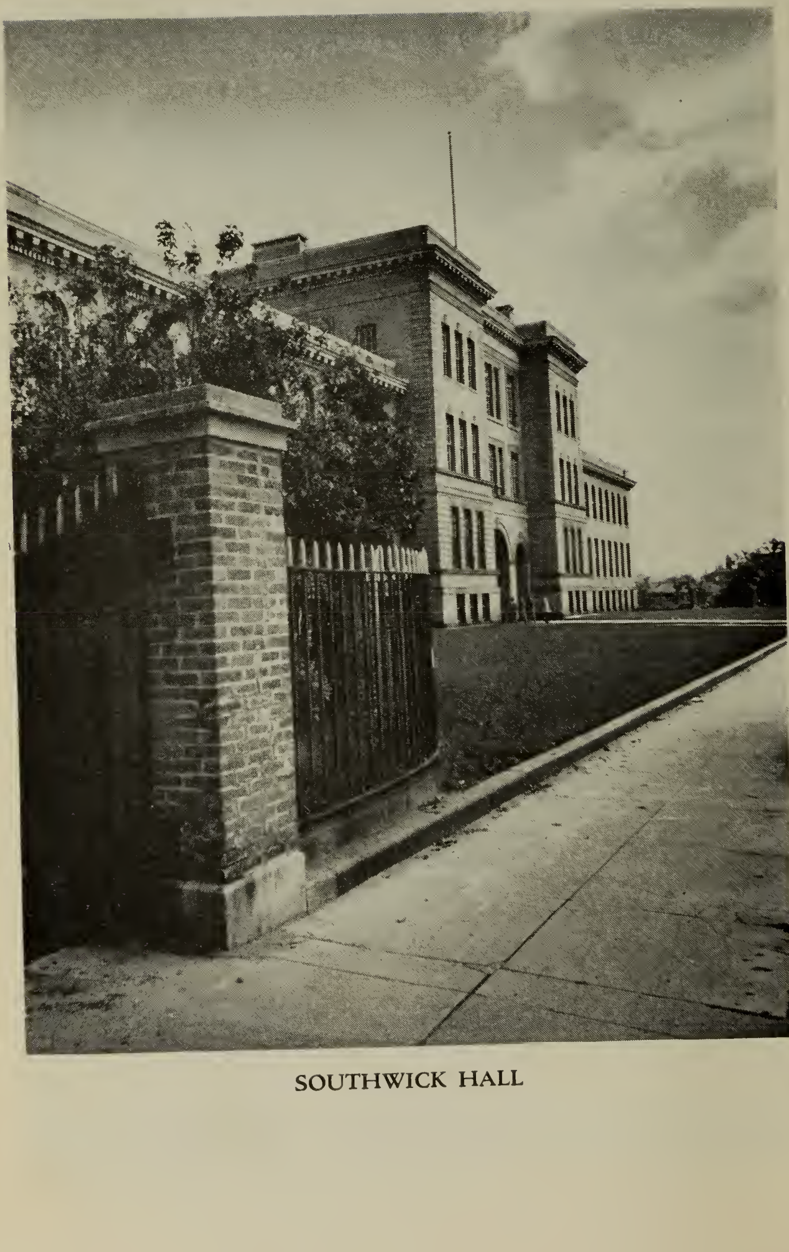
Power Plant—Back of great quadrangle.

Athletic Field—northeast of main campus. First used for baseball in 1938, this area is being further improved to provide a modern athletic center for baseball, lacrosse, soccer, softball and Physical Education classes. AF-ROTC also uses this area as a drill field.

EQUIPMENT

Now housed in the various buildings of the quadrangle is an extremely varied set of textile machinery covering all of the basic systems for handling staple and continuous filament fibers, from raw material to finished products, including special types of looms, and lace-making machinery. The Paper and Leather Building houses the machinery essential to instruction in all phases of the manufacture, control, and testing of all grades of paper and leather. All machines and equipment will, as now, be closely integrated with modern laboratories in physics, chemistry, and engineering, and in chemical, physical, and optical testing. All laboratories, including those with machines which are exact replicas of commercial models, are geared to both teaching and research.

GENERAL VIEW OF SMITH HALL AND MAIN BUILDINGS



SOUTHWICK HALL

GENERAL INFORMATION

ADMISSIONS

New students at the Lowell Textile Institute are selected by a group of faculty members functioning as the Committee on Admissions. The Committee endeavors to accept for membership in the freshman class those applicants who, during their preparatory education, have shown evidences of promise in scholastic ability, strength of character, and leadership. In addition to test results, scholarly attainments, and other traditional standards of measurement, the Committee sets a high value on the personality characteristics of each individual candidate, together with his extracurricular interests and contributions to school and community life.

PROCEDURE

Formal application for admission should be made as early as possible in the candidate's senior year of secondary school. (Students from foreign countries are strongly advised to begin admission procedures not less than twelve months in advance of the expected date of enrollment.) Requests for application blanks and all correspondence relating to matriculation at the Institute should be addressed to the Director of Admissions. Preliminary correspondence before the senior year is welcomed, and encouragement is extended to every effort which will tend to harmonize the prospective student's interests and activities with his freshman year at the Institute.

Steps to be taken for admission are:

1. Pages one and two of the admission application form should be completed by the candidate.

2. Attach a certified check or money order in payment of the application fee of $10. (See "Student Expenses" for explanation.)

3. The whole application form should then be submitted to the office of the candidate's secondary-school principal, with the request that his office fill out pages three and four and mail the completed application directly to the Director of Admissions.

It is recommended that this procedure be accomplished as soon as possible in the candidate's senior year in secondary school so that he may be considered for admittance to classes beginning the next September.

4. All candidates for scholarships should make direct application to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey, with a request to take the Scholastic Aptitude Test, described below under the heading *Requirements*.

5. Each applicant must submit to a complete health examination by his family physician. A certificate of good health, indicating the date of this examination, must then be sent by the physician to the Director of Admissions. The Committee has prepared a special form for the convenience of the physician; a copy of this certificate of health will be supplied.

6. A personal interview with the Director of Admissions is strongly recommended. The Office of Admissions at the Institute is open for this purpose Monday through Friday, from 8:30 a.m. to 4:00 p.m. during the school year. *It is urged that appointments for an interview be made in advance.*

REQUIREMENTS

Fulfillment of prescribed requirements does not automatically constitute the acceptance of a candidate. The final decision as to the eligibility of an applicant shall be left to the discretion of the Committtee on Admissions.

The conditions under which an applicant may be accepted are as follows:

1. A candidate for admission must be a graduate of a secondary school approved by the New England Entrance Certificate Board, the Regents of the State of New York, or a Board of equal standing.

2. (a) Because of the specialized nature of the various curricula at Lowell Textile Institute, it has been deemed advisable that all entering students shall have completed the following units of secondary-school study:

Algebra (quadratics and beyond)	2 units
Plane Geometry	1 unit
English	4 units
American History	1 unit
Chemistry (including laboratory)	1 unit
or	
Physics (including laboratory)	1 unit

Preference will be given to applicants offering both chemistry and physics. In addition to the above-listed prerequisites, each applicant must offer credit in elective subjects, such as: languages, other than English; history, other than American; mechanical drawing, solid geometry; advanced algebra; scientific subjects; social studies, and others. Trigonometry is recommended but not required.

(b) The combined prerequisites and electives should total at least 15½ Carnegie units. Each such unit of preparatory credit is the equivalent of one secondary-school subject satisfactorily pursued during one academic year of at least thirty-six weeks of four forty-minute meetings each week, or the equivalent.

(c) In evaluating the credits offered by an applicant for admission, the Committee will be guided primarily by the quality of his scholastic record and by his apparent promise on grounds of intellect and character. Therefore, an applicant whose preparation has not followed the normal pattern with respect to the accumulation of unit credits should not hesitate to apply for entrance, provided that the quality of his scholarship gives evidence of ability to do college work and provided that he is recommended by his school. (For additional information, see paragraph "Exceptions to Admissions Rules" below.)

3. All candidates for admission who are also applying for a scholarship must complete the Scholastic Aptitude Test which is prepared, administered, and graded independently of Lowell Textile Institute. Application to take the test must be made directly to the College Entrance Examination Board, P. O. Box 592, Princeton, New Jersey. Arrangements to take the test, which is scheduled annually for the early part of March, should be completed as early as possible in the candidate's senior year in secondary school.

Exceptions to Admission Rules—In special cases, at the discretion of the Faculty Committee on Admissions, applications may be accepted from candidates in the following categories:

1. Applicants who lack credit in specified required subjects because they are not offered in the course of study at their secondary school. Such applications

will be considered only when the quality of work done in other departments is exceptionally high.

2. Applicants who offer credit in all the required subjects, but whose accumulation of unit credits does not total 15½. Very few students will find themselves in this category, because most secondary schools require at least 15½ units for graduation. However, the Committee is willing to recognize the possibility that a student, well-qualified in all other respects, should not be denied the opportunity to submit his application because of purely quantitative considerations.

3. Applicants who have not maintained a uniformly good scholastic average in all subjects but are otherwise acceptable may be required to pass certain tests given by the Guidance Department of Lowell Textile Institute. These tests will be in subjects prescribed by the Committee on Admissions.

TRANSFER STUDENTS

Transfer students are expected to have demonstrated outstanding ability, must submit transcripts of their college record and letters of honorable dismissal, and must supply cogent and positive reasons for wishing to enroll at Lowell Textile Institute. While every effort will be made to grant acceptable applicants for advanced standing full credit for previous college and/or military training courses, the final decision in this matter will rest with the Head of the Department concerned.

Because of the nature of the courses of study at the Institute, it is usually difficult for a transfer student to construct a program which will be completely satisfactory. In general, a transfer can be accomplished only at the expense of sacrificing some time and credit. With that thought in mind, the Committee entertains consideration of advanced standing applications only when they include a well-developed plan of study, which the candidate submits as being acceptable and suitable for his purpose. The Director of Admissions and/or the Registrar will gladly advise prospective applicants concerning this plan of study, and other matters concerned with advanced standing, by means of correspondence, or interview, or both.

Occasionally, an undergraduate may leave the Institute to study elsewhere after which he wishes to return to the Institute. Re-entry under such conditions is by no means automatic. Each application will be considered in the light of its individual merits. Credit for courses taken at other institutions will be given wherever feasible, but the Faculty reserves the right to require that candidates for re-admission take such subjects as it deems necessary in the construction of a sound program, even though the course material may have been previously studied. Since each individual case is different, no hard-and-fast rule can be laid down, but in general, credit will be given only when good or superior work has been demonstrated.

An application listing all courses for which transfer credits are desired must be filed well in advance of the prospective date of enrollment, or re-entry, in order that the Heads of the Departments concerned, and interested staff members, may have ample time to evaluate and pass upon the credits requested. No supplementary applications shall be recognized after a student has been officially notified of his acceptance for re-entry or for transfer admission.

SPECIAL STUDENTS

Although most applicants for admission will wish to enroll for the full four-year degree program, a few persons may wish to take specialized work without regard for degree credit.

Special students usually are expected to conform to the general rules and regulations as specified by the Faculty. Their plan of study may not be of such a nature as to deviate markedly from the regularly formulated subject matter and laboratory courses; and acceptance to special status is contingent upon the consent of the instructor in charge of each course to which admittance is sought.

The Committee admits only a few highly qualified students to special status each year. For detailed information concerning specific programs, applicants should communicate directly with the Director of Admissions.

FOREIGN STUDENTS

Each year the Lowell Textile Institute accepts for admission foreign applicants up to 5% of the total number of students in any given class (freshman, sophomore, etc.). There are no special procedures to be observed by foreign candidates, although it is urged that they endeavor to have the transcript of their secondary-school and/or college records, as well as all other admission materials submitted, in English, *not less than twelve months in advance of the expected date of enrollment.* All applicants should have a considerable facility in speaking and writing English, and have financial resources sufficient at least for their first year of study. Foreign students will be expected to complete the same schedule of courses as is assigned to all other students.

In all respects, the admission procedures for foreign students are identical with those required of U. S. citizens.

To facilitate their adjustment to the life of the campus, undergraduate foreign students are regularly assigned room space, shared jointly with American students, in the residence halls of the Institute. Graduate students spend at least their first year at the Institute in a residence hall room. Students attending for the first time should note that towels, sheets, pillowcases, and blankets must be supplied by occupants of rooms. Students are therefore reminded that bedding, as well as clothing, should be suitable for a climate in which temperatures normally fall well below the freezing point during the winter months.

RESIDENCE HALLS

The Board of Trustees has stated the policy that the residence halls shall be completely occupied. Therefore, the following rules have been established to accomplish these ends.

1. All male students are required to live in the residence halls unless excused in writing by the Dean of Students. While such excuses are normally granted for the academic year, they are subject to review at the beginning of each semester and may be cancelled should conditions require.
2. Application for permission to occupy other living quarters will be made on special blanks available at the Dean of Student's office. An application must be filed annually by each student. Deadlines for filing applications are: (a) for all new students (incoming freshmen, transfer students, special students, or graduate students—on or before September 1 of each year; (b) for all regularly enrolled students—on or before June 1 of each year.
3. In granting special permission, the Dean of Students will give full consideration to the following:

   a. Distance from Institute to place of legal residence.

   b. Financial hardships involved in living in residence hall.

   c. Year of the student (freshman, sophomore, junior, senior, graduate).

   d. Membership in fraternities that maintain a fraternity house.

Rooms are adequately furnished and are cared for by the students occupying them. Sheets, pillowcases, blankets, towels, and other personal linens must be supplied by each student. Each occupant is held responsible for any damage done to furniture and equipment.

Assignments of rooms in the residence halls are made through the Office of the Dean of Students. All assignments are for the full academic year. Change of room is not permitted except under unusual circumstances, and may be accomplished only after a formal application has been approved by the Dean of Students.

All rentals are uniform, the annual charge being $275.00 per academic year for each student. While this charge covers occupancy during periods that the Institute is regularly in session, it may, at the option of the Institute, be extended to vacation periods.

Assignments of rooms are made as equitably as possible and in the order that applications are received. For those students who are unable to be placed in residence halls, the Dean's Office supplies a list of approved rooming houses where students may reside.

ORIENTATION

Each freshman is expected to be in daily attendance beginning Monday, September 14, at 8:30 a.m., and to follow the prepared program which will be placed in his hands at that time. Late registration for all students at the Institute is subject to a five-dollar fine, unless accompanied by a medical or equally acceptable excuse.

Freshman Week—Freshman Week will be devoted to facilitating the adjustment of the beginning student to his new physical and social surroundings. Under the sponsorship of the Committee on Student-Faculty Relations, a program of meetings, lectures, and conferences will be presented in order to acquaint the entering class with the traditions, customs, rules and regulations, courses of instruction, organizations, recreational and other facilities of the Lowell Textile Institute.

Faculty Advisers—During Freshman Week, each entering student will be assigned a member of the faculty who will serve as his faculty adviser for the next two years. The advisers function as a counseling link between the student and his academic and personal problems.

Freshman Orientation Program—All new students at the Institute are required to attend the program of Freshman Orientation. Meetings are held once each week for two semesters. While the program carries no credits, it is designed to assist the freshman to make the adjustment to college life, and to teach him how to get the most out of his work at the Institute by efficient use of his time and talents. The work of the second semester attempts to develop his ability to think for himself, and to react thoughtfully and intelligently to ideas and viewpoints expressed in topics assigned for discussion.

GUIDANCE

A committee of faculty members supervises a guidance program which begins with the admission procedures, continues throughout the undergraduate years, and culminates in the work of the Placement Office.

Because living on-campus is an important aid in helping the new student adjust to college life, it is required that all freshmen and sophomore students, except those who have permission to live at home or in fraternity houses, take residence in the dormitories.

Guidance in the freshman year stems mainly from the results of the admissions testing program, Freshman Week activities, the Effective Study course, and the work of the Faculty Advisers. These same advisers function throughout the sophomore year, but during the junior and senior years the heads of departments and the Office of the Dean of Students take over primary responsibility for the students' personal and scholastic welfare.

The Office of the Dean of Students is open to all undergraduates at all times to assist the student in attaining his academic objective, and to assure his active, enjoyable participation in the work and affairs of the Institute.

The Placement Office functions as a natural outgrowth of the undergraduate guidance program. This office endeavors to keep Institute graduates in constant contact with the latest developments in the textile and allied industries, so that they may place themselves in positions best suited to their talents and abilities.

HEALTH SERVICE

The Dispensary, in Smith Hall, is in charge of a registered nurse eight hours each school day. She is on call 24 hours daily, including weekends. Students receive first aid treatment at the Dispensary, and are advised as to the best procedures in case of illness.

The college physician is on call 24 hours daily. If any student requires hospitalization, the college physician will arrange for admission to one of the three excellent, modern hospitals located in the immediate vicinity of the Institute. Medical fees and hospital charges are at the expense of the student.

Low-cost Group Accident and Sickness Insurance is also available to all students on a strictly voluntary basis.

STUDENT EXPENSES

The various student expenses described in this section apply only to the regular day school of Lowell Textile Institute. The fees and expenses of the Lowell Evening Textile School are described in a separate bulletin. All fees are established by the Board of Trustees and are subject to change without advance notice.

Payment of tuition and fees is an integral part of the registration process which must be completed before a student may attend classes. In special cases, a delay in the payment of fees may be authorized but all fees *must be paid* on or before the close of the sixth week of classes of the semester involved. Requests for delay must be approved *before* a student's registration is complete.

APPLICATION FEE (First year of registration only.) $10

Payable by certified check or money order and filed with the Director of Admissions at the time of application.

a. If the applicant is accepted for admission and is duly enrolled as a student at the Institute, the entire amount of this fee shall be credited toward his tuition charges on the day of registration.

b. If the applicant is not accepted for admisison as a student, the entire amount of this fee shall be refunded.

c. If the applicant is accepted for admission but does not choose to enroll as a student, no refund shall be made.

d. If the applicant is accepted for admission but is called to duty in the Armed Services of the United States, he shall, upon presentation of suitable evidence of this fact, be entitled to a refund of the entire amount of the application fee.

TUITION—The yearly tuition fees are:

Residents of the Commonwealth of Massachusetts	$150
Non-residents	$250
Foreign students	$500

Students who are classified by the United States Immigration Authorities as "Displaced Persons" will pay non-residents' tuition of $250.

Special students pay, in general, the full tuition fee. However, if enrolled in only a limited number of courses, a special student may make application to the President for a reduction in tuition.

RESIDENCE: As defined by The Board of Trustees—

Because Lowell Textile Institute is a state-supported institution, its educational program and facilities are made available at a low tuition rate to students entering from the Commonwealth. Eligibility for admission as a resident entitled to the low residential tuition is determined under policies established by the Board of Trustees.

a. Every student claiming residence in Massachusetts must file with the Bursar a certificate signed by either the town or city clerk of the community claimed as legal residence, stating that the student's parents, or guardian, are legal residents of the Commonwealth of Massachusetts.

b. The residence of a minor shall follow that of the parents, unless the minor has been emancipated. A minor student who has been emancipated shall, in addition to the requirements respecting residence, present satisfactory documentary evidence of emancipation.

c. A minor under guardianship shall be required to present satisfactory documentary evidence of the appointment of a guardian in addition to the certificate of residence of the guardian.

d. A student shall not be considered to have gained residence in the Commonwealth of Massachusetts by reason of attendance at Lowell Textile Institute, nor shall a student lose residential preference during continuous attendance at the Institute.

e. The residence of a wife shall follow that of the husband.

f. The prescribed form of application for classification as to residence shall be executed for each student. Misrepresentation of facts to evade payment of the proper rate of tuition shall constitute sufficient cause for suspension or permanent separation from the Institute.

g. Payment of one-half of the total yearly tuition will be made during the registration for each semester.

h. The President of the Institute is authorized to adjust individual cases within the spirit of these rules.

Excess Hour Fee . . . . $12.50 per credit hour

A charge for each credit hour in excess of the number of credit hours officially prescribed for the course and semester in which the student is enrolled.

ROTC Deposit $25

This deposit covers loss of/or damage to uniform or equipment used for ROTC instruction. Required of all students enrolled in ROTC. The entire amount, less charges, will be refunded upon the completion of the ROTC requirements. If, at any time, the charges against a student exceed the amount on deposit, the student will be required to pay such charges and to make an additional deposit of $25.

Activity Fee $30

Each student will pay, at his first registration for each academic year, an activity fee of $30.00. The payment of this fee entitles the student to free admission to all athletic events, a mailbox in the campus postoffice, a subscription to the student newspaper, and a copy of the yearbook. A portion of this fee helps to support the general student activities under the jurisdiction of the Student Council.

General Breakage Deposit $15

To cover all breakage or damage to Institute property, including residence halls.

Residence Halls $275

All students, except those who live in Lowell or the surrounding community, may be required to live in one of the residence halls, (see page 24 for details). The double rooms rent for $275 per student per year. One-half of the rent ($137.50) is payable at the start of each semester.

Laboratory Charges

a.	Freshman Chemistry Fixed charges, $15; breakage deposit, $10	$25/year
b.	Advanced Chemistry Fixed charges, $15; breakage deposit, $10	$25/semester
c.	Textile Finishing Fixed charges, $20	$20/year
d.	Machine Tool Laboratory Fixed charges, $10; breakage deposit, $5	$15/year
e.	All Manufacturing Laboratories (Textile, Paper, Leather, etc.) Fixed charges, $5	$ 5/year

All laboratory charges must be paid before students can be admitted to laboratory work. The unexpended balance of all deposits will be retained as a credit against laboratory charges incurred in subsequent semesters. Upon graduation or withdrawal from the Institute any unused portion remaining to the student's credit will be refunded.

Commencement Fee (Payable at beginning of senior year.) . . . $15

Covers commencement expenses such as diploma and case, rental of cap and gown, ten invitations per student, printing and other incidentals.

Late Registration Fee $5

Any student who does not complete his registration (including the payment of all fees) by the close of the registration period stated in the Institute calendar may be required to pay an additional fee of $5.00.

Official Transcript Fee $1/copy

Each student will be allowed free of charge a total of three transcripts of his scholastic record. A charge of $1.00 per copy will be made for each *additional* transcript.

Books and Materials—Students must provide their own books, stationery, tools, etc., and pay for any breakage or damage that they cause to machines, laboratory equipment, and other property of Lowell Textile Institute.

All raw stock and yarn furnished to the students, and all the productions of the Institute, remain or become its property, except by special arrangement, but each student is allowed to retain specimens of yarn or fabrics that he has produced, if mounted and tabulated in accordance with the requirements of the department. It is understood that the departments may retain such specimens of students' work as they may determine.

No books, instruments, or other property of the Institute loaned to the students are to be removed from the premises except by special permission.

Refund Schedule: Applications for Refunds, filed with the Bursar on withdrawal, will be made in accordance with the following table:

No. of Weeks		*Refund*
At least	*But less than*	*Rate*
0	2	80%
2	3	60%
3	4	40%
4	5	20%
5 and over		None

SUMMARY OF EXPENSES PER YEAR

Application Fee	$ 10
Tuition (residents of Massachusetts)	150
Tuition (residents of other States)	250
Tuition (residents of other countries)	500
Dormitory rate per year	275
Excess Hour Fee (per hour)	12.50
Laboratory Charges	
a. Freshman Chemistry	25
b. Advanced Chemistry	50
c. Textile Finishing	20
d. Machine Tool Laboratory	15
e. All Manufacturing Laboratories	5
Student Activity Fee	30
ROTC Deposit	25
General Breakage Deposit	15
*Books and supplies	50
Commencement Fee	15
Late Registration Fee	5
Official Transcript Fee	1

*Books and supplies for the first year cost about $80, second and third year $35, and fourth year $50, thus averaging about $50 per year for the four years.

STUDENT SCHOLARSHIPS

Scholarships:—A limited number of scholarships is available to students of Lowell Textile Institute through funds contributed by various companies representing the textile or allied industries.

A. Administered by the Committee on Scholarships

1. *Fiberglas Scholarships—sponsored by the Owens-Corning Fiberglas Corporation.*

This scholarship is awarded annually to an outstanding sophomore in any of the textile courses. It pays the recipient full tuition and $500 per academic year for each of the junior and senior years. Selection is based upon academic record, character, qualities of leadership, and need.

2. *Russell L. Brown Scholarship—donated by Davis and Furber Machine Company*

Open to a student acceptable to Lowell Textile Institute who plans to enroll in the curriculum of Textile Engineering or Wool Yarn Manufacturing. Preference given to employees and sons or grandsons of employees of Davis and Furber Machine Company. Selection based on general scholarship, initiative, and need. Stipend $300. Appointments are for one year only but are renewable.

3. *Ralph E. Hale Scholarship of the Northern New England Section of the American Association of Textile Chemists and Colorists (1947).*

Established by the Northern New England Section of the American Association of Textile Chemists and Colorists in memory of Ralph E. Hale, 1951 Chairman-elect of the Section. This scholarship is awarded annually to a student at the completion of his or her junior year in the course in Chemistry, Textile Coloring, and Finishing. The amount of the scholarship is $250 per year.

4. *Arthur Besse Memorial Scholarship—awarded by the Arthur Besse Memorial Trust.*

This scholarship is awarded to a student majoring in Woolen and Worsted Manufacturing and planning to continue in that industry after graduation. Awards are based on need, scholarship, and qualities of character and leadership. The amount of the scholarship is $500 a year.

5. *Sylvan I. Stroock—established by S. Stroock & Co., Inc. and offered annually.*

Awards will be made on the basis of scholarship, financial need, leadership, and promise of success in textile fields. The sum available for scholarship purposes is $500 per year.

B. Administered by the Agency Designated

1. *Alumni Association Scholarships*

Scholarship funds under the care of the Alumni Association make available several scholarships a year which cover tuition and miscellaneous fees.

Application should be made through the Alumni Office, Lowell Textile Institute.

2. *Berkshire Fine Spinning Associates, Inc. Scholarships*

A number of scholarships covering tuition and living expenses for four years are offered in Textile Engineering and Cotton Manufacturing by the Berkshire Fine Spinning Associates, Inc., Providence, Rhode Island. Eligible applicants are:

a. Male employees of Berkshire Fine Spinning Associates, Inc., who have had adequate secondary school training.

b. High school graduates who are sons of present employees.

Interested students should contact the Berkshire Fine Spinning Associates, Inc., Turks Head Building, Providence 1, Rhode Island.

3. *New England Tanners Club Scholarship—awarded by annual vote of the New England Tanners Club.*

When awarded, this scholarship is granted to a student in Leather Engineering at Lowell Textile Institute. Preference is given to employees of the member companies of the New England Tanners Club or to their families. If no eligible applicants are available, awards will be open to others on the basis of secondary school scholastic performance and evidence of potential leadership. The amount of the scholarship is $500.

4. *Goodall-Sanford, Inc. Scholarships*

Goodall-Sanford, Inc., Sanford, Maine, offers to eligible employees of the company full four-year scholarships, the recipient to receive income at the rate enjoyed by the candidate while in the employ of the company. Successful candidates may choose any textile school certified by Goodall-Sanford, Inc., Lowell Textile Institute being one of these approved schools.

Application should be made to Goodall-Sanford, Inc., Scholarship Committee, Sanford, Maine.

5. *New England Textile Foundation Undergraduate Scholarships*

Scholarships of $500 per year are available by means of competitive examination to students who qualify for entrance to Lowell Textile Institute under the terms described in the ADMISSION section of this Bulletin. All students interested in competing for one of these awards should make application directly to the New England Textile Foundation, 31 Canal Street, Providence, Rhode Island, no later than January 15, 1954. Detailed instructions and the necessary application forms will be sent to each applicant accepted for the competition.

6. *Pacific Mills Worsted Division Overseers Association Scholarships*

Several $500 scholarships are supported by the Overseers Association of the Pacific Mills Worsted Division, Lawrence, Massachusetts. The Overseers Association selects qualified candidates, who must then meet with the approval of the Admissions Committee of Lowell Textile Institute.

7. *United Elastic Corporation Scholarships*

Scholarships in the amount of $150 are available through the United Elastic Corporation, Easthampton, Massachusetts.

These scholarships have been established primarily for employees of United Elastic Corporation, or members of their families. Other residents of the communities where plants are located, however, may enter applications for consideration. Preference is given to native New Englanders and to those who agree to work summers in approved mills.

Qualifications for scholarships include: good character and standing in the community, aptitude for technical training, and ability to pass entrance requirements of Lowell Textile Institute, and/or with the approval of the United Elastic Corporation and the Lowell Textile Institute, scholarships may be awarded to deserving upperclassmen.

Granting of a scholarship shall be for a one-year period and further extension will be made in accordance with the initiative and progress by the student during the year. The United Elastic Corporation will, so far as possible, furnish suitable employment to the student during the summer vacation period and following graduation.

All applications should be made through the plant nearest to residence of applicant. Plants are located at Easthampton, Lowell, and Littleton, Massachusetts; West Haven, Connecticut; and Stuart, Virginia.

8. *Jacob Ziskind Memorial Scholarship*

Established by the employees of the Merrimack Manufacturing Company in memory of Jacob Ziskind.

Qualifications include: Good character, scholastic record, initiative and ability to pass the entrance examination at Lowell Textile Institute.

Preference in granting the scholarship will be given employees of the Merrimack Manufacturing Company or members of their immediate families residing in the Greater Lowell area. However, other residents of Greater Lowell may enter applications for consideration.

The Merrimack Manufacturing Company will, in so far as possible, provide suitable on-the-job training during the summer vacation period and following graduation.

The scholarship provides tuition, books, supplies and such deposits as are required to properly enroll the student in the course selected.

C. Administered by the Agency Designated in Collaboration with the Committee on Scholarships

1. *New England Paper Merchants Association Scholarship—donated by the Association*

This scholarship, open to any student in the Paper Engineering Department who is a resident of New England, is awarded on the basis of scholarship and general character. The amount of the scholarship is $150.

2. *Boston Paper Trade Association Scholarship—donated by the Association.*

This scholarship, open to any student in the Paper Engineering Department who is a resident of New England, is awarded on the basis of scholarship and general character. The amount of the scholarship is $150.

3. *H. Webster Thomas Memorial Scholarship—donated by the Rohm and Haas Corporation*

This scholarship is awarded for a four-year period to a student in Leather Engineering at Lowell Textile Institute. Established by Rohm and Hass Corporation as a memorial to H. Webster Thomas. The amount of the scholarship is $500 per year.

Application for the above scholarships should be filed with the Dean of Students not later than February 1.

4. *The McLaurin-Jones Scholarship—donated by the McLaurin-Jones Company.*

This scholarship is awarded annually to a member of the Brookfield or Ware High School graduating class or to an employee of the McLaurin-Jones Company for work in the Paper Engineering Department. The scholarship for $500 is renewable from year to year for four years dependent upon a satisfactory scholastic record being maintained.

Applications for the above scholarships must be filed not later than February 1 with the Dean of Students.

5. *The Gehring Foundation Memorial Scholarship—in memory of Henry G. Gehring and his son, Edward H. Gehring,* both of whom were engaged in *the Lace Industry.*

These scholarships are made possible as a result of the Gehring Memorial Foundation of New York, the James T. and Steven E. Smith Memorial Funds,

the Warwick Chemical Foundation Scholarship Fund in memory of Walter Nowicki, and other scholarships presented and designated by various textile companies.

Selection of recipients, made by the Scholarship Committee, may be reviewed by the Gehring Foundation.

Application should be made through the Alumni Office, Lowell Textile Institute.

FELLOWSHIPS

A. Open only to graduates of Lowell Textile Institute

1. *Lowell Textile School Fellowship—sponsored by the Proprietors of the Locks and Canals on the Merrimack River.*

   Pays tuition for graduate work at Massachusetts Institute of Technology.

B. Open to graduates of textile schools.

1. *Clark Thread Company Fellowship*

   Stipend: $1200 and tuition. For graduate work at Massachusetts Institute of Technology.

2. *New England Textile Foundation Graduate Fellowship*

   Stipend: $1000 plus tuition. For graduate work at Massachusetts Institute of Technology.

LOAN FUND

A loan fund is available to needy students through the Lowell Textile Associates, Incorporated. Students may make application for a loan through the Faculty Loan Committee. Repayments on any loan which are made while the student is still in school are interest free. Loans repaid after the student leaves school (for whatever reason) bear 4% interest beginning three months after the date at which the student officially leaves school. Repayments are not required until the student separates from Lowell Textile Institute, at which time repayments are due quarterly at a rate of $10.00 per quarter the first year and $20.00 per quarter each year thereafter until the loan is repaid. Additional payments may be made at any time so as to reduce indebtedness at a more rapid rate.

STUDENT AWARDS

The following awards are given annually at Commencement:

1. *The Cotton Medal.*—Given by the National Association of Cotton Manufacturers to that member of the graduating class in the courses of Textile Engineering (General Option) or Cotton Yarn Manufacture who has maintained the highest scholastic standing throughout the four years of his undergraduate work.

2. *Book Prize.*—Given by the American Association of Textile Chemists and Colorists to the outstanding graduating senior in the course of Chemistry, Textile Coloring, and Finishing. The recipient is selected by the Chemistry Department and the academic standing of the candidates is an important factor. The award includes also a junior membership for one year in the A.A.T.C.C.

3. *Louis A. Olney Book Prizes.*—Selected reference books are awarded annually to the outstanding freshman, sophomore, and junior students in the course of Chemistry, Textile Coloring, and Finishing. The recipients are selected by the Department of Chemistry and the academic standing in the subjects of their major field for the past year is an important factor.

4. *Phi Psi Award.*—This award is given annually to an outstanding member of the graduating class in a Textile course on the basis of scholastic standing, leadership, initiative, personality, loyalty, and courtesy.

5. *American Association of Textile Technologists Award.*—Given annually by the American Association of Textile Technologists, Incorporated, to a member of the Senior Class who graduates in any textile course. Recipients are selected upon the basis of scholarship, technical ability, industry, judgment, leadership, reliability, and ability to work with others.

STUDENT LIFE

Lowell Textile Institute believes that sound educational practice seeks to develop the whole personality of the student. Accordingly, Faculty and Administration encourage extra-curricular activities and support the development of a varied and well-rounded program of activities to supplement the purely academic phase of undergraduate life. This program provides opportunity for participation in formal and informal sports; in class and campus self-government; and in the many clubs and special interest activities which appeal to the varied interests of the student body.

ATHLETICS

Under the supervision of the President and the Faculty, the Athletic Association promotes an extensive varsity and intramural sports program. By virtue of their payment of the Student Activity Fee, all students are members of the Athletic Association and receive free admission to all intercollegiate contests played at home. Basketball and baseball teams compete with teams throughout the Northeast. Golf, soccer, lacrosse, and ski teams also compete regularly with other colleges.

Intramural sports are sponsored by the Director of Intramural Athletics. This program includes both league and informal competition between the classes, residence halls, and the fraternities.

STUDENT GOVERNMENT

The Student Council is the chief body for the conduct of self-government in student affairs. It is composed of four officers elected at large by the student body, and the president and a representative elected by each of the four undergraduate classes.

By virtue of its function as chief governing body for student affairs, it exercises administrative control over all campus organizations formed under its supervision; represents the student body in matters requiring conference with the Administration and Faculty; investigates grievances submitted by students or student groups; sponsors all-campus dances, banquets, and other social affairs; and supervises the expenditure of the unallocated portion of the Student Activity Fee. It functions in accordance with the specific prescriptions of its Constitution and By-Laws.

SCHOLASTIC HONOR SOCIETY

Tau Epsilon Sigma is the scholastic honor society at Lowell Textile Institute. Election is open only to seniors who have been on the Dean's List for six consecutive semesters, or who have maintained an honor standing for four years, without any failure.

CLUBS

The following clubs maintain a prominent position in the extra-curricular life of the campus:

1. Student Chapter, American Association of Textile Chemists and Colorists
2. The Engineering Society
3. International Club—for foreign students
4. Rifle Club—which participates in intercollegiate matches.
5. Band
6. Newman Club
7. B'nai B'rith Hillel Counsellorship
8. Arnold Air Society—Honorary ROTC Society

DRAMATICS

The Textile Players constitute the center of all dramatic activities of the campus. For years, the annual productions of this group have been a high point in the social calendar of the Institute.

PUBLICATIONS

The TEXT is the campus newspaper. Prepared and edited by a student staff, this bi-weekly publication offers excellent journalistic and business experience to those who work on its staff.

The PICKOUT is the annual yearbook of the campus. Those who serve on the staff secure a vauable training in the editorial, art, and business problems involved in the production of a top-quality picto-literary history of an academic year. Supported by allotments from the Student Activity Fee.

GREEK LETTER SOCIETIES

Five Greek letter social groups have been granted official recognition by the Administration of Lowell Textile Institute.

The four fraternities, located in their own quarters, are as follows: Delta Kappa Phi, Omicron Pi, Phi Psi, and Pi Lambda Phi. The activities of these fraternities are co-ordinated through membership in the Interfraternity Council.

The sorority, Phi Sigma Rho, provides a center for the social life and mutual association of the young women studying at the Institute.

STUDENT RULES AND REGULATIONS

Students admitted to Lowell Textile Institute are assumed to be ladies and gentlemen, and of sufficient maturity and poise to enable them to live in an adult environment. Such living involves full respect for the rights of others, a regard for self-discipline and good order, and a high standard of honesty and of moral conduct.

In consequence of these assumptions, the regulations are framed not to restrict the conduct of individuals or groups of students, but, rather, to set forth the basic policies of the Faculty established in order that a large student body may live and work harmoniously together with a minimum of friction and misunderstanding. By the same token, even though the rules are neither detailed nor comprehensive, a student may be dropped from the rolls, or subjected to other disciplinary action, for conduct which is illegal, immoral, or inimical to the best interests of the Institute, regardless of whether or not the particular offense is listed in these rules and regulations.

ATTENDANCE

Attendance is expected of all students at all classes. The supervision of student attendance is lodged in the Office of the Dean of Students, both as to the announcement of detailed instructions, and as to the enforcement of the rules established by the Faculty. Students charged with unexcused absences, particularly absences immediately before and after holiday and vacation periods, are subject to disciplinary action.

DISCIPLINARY ACTION

Disciplinary action originates in the Office of the Dean of Students. Such action may be in the form of any of the following degrees of severity: Censure, Restriction, Suspension, or Dismissal. Whenever disciplinary action is taken, a notation of such action becomes a part of the permanent record of the student.

GRADES

For the Classes of 1953 and 1954, semester grades are reported, by letter, as follows:

H 90-100, 5 points
C 80-89, 4 points
P 70-79, 3 points
L 60-69, 2 points
F 50-59, 1 point (condition—entitled to re-examination)
FF Below 50, failure (no credit unless subject is repeated)

The student's semester rating is a weighted value used to denote his relative standing. It is dependent upon the point value of his final grade and the credit hours allotted to the subject. To compute, the point value of the final grade is multiplied by the credit hours carried by the subject. The total of the calculated values is divided by the sum of the credit hours. The result is the student's semester rating. The cumulative rating covers two, or more, semesters, and is computed by the procedure followed in computing the rating for a single semester.

For the Class of 1955, and those following, semester grades are reported, by letter, as follows:

A	90-100, 4 points
B	80–89, 3 points
C	70–79, 2 points
D	60–69, 1 point
F	Below 60, Failure
I	Incomplete
W	Withdrawn
X	Dropped

SCHOLASTIC REPORTS

Reports of scholastic standing are compiled regularly at the end of each semester. Unsatisfactory mid-semester grades are submitted to the office of the Dean of Students for guidance purposes, but formal notification of each student's status is made only at the conclusion of each semester.

DEAN'S LIST

The Dean's List is composed of those students who have a semester rating of 4.00 (3.00, new system) or higher, with no current failures.

PROBATION

A student is placed on probation when his semester rating is below 2.26 (1.25, new system). The probationary period covers the entire semester following the issuance of the semester rating which placed the student on probation.

A student with a rating of less than 2.26 (1.25, new system) for two consecutive semesters shall be dropped from the Institute for at least one semester.

A student on probation may not represent the Institute in any public function and may not hold class or other offices during his term of probation.

If a student receives a semester rating below 1.00 (0.50, new system), he may automatically be dropped from the Institute without benefit of a probationary period.

REQUIREMENTS FOR GRADUATION

Only those students who have satisfied the following minimum requirements will be recommended for the baccalaureate degree:

1. Successfully completed one of the curricula prescribed for this degree (see Pages 45 to 58) with a cumulative point average of at least 2.5 (1.5, new system).
2. No substitutions for subjects required to be taken in the major department;
3. Substitutions may be presented for subjects required in fields outside of the major department, provided such substitutions are approved by the Dean of Students, are in the same area of learning, require an equivalent amount of time for their completion, and, if not taken at the Institute, the credit is acceptable to the Registrar's Office and the Department Head concerned. For this purpose, the Registrar will not accept transfer credit when the grades are less than P, nor include such transfer credits when calculating the cumulative average.

GRADUATION HONORS

Academic honors are awarded at the annual Commencement Exercises by appropriate notation on the diploma for the baccalaureate degree, and by printing in the commencement program the names of students who have earned such recognition. Honors are awarded according to the following standards of achievement:

a. Any student who graduates with a rating of 4.00—4.49 (3.00—3.49, new system) for the entire period of study at L.T.I. shall be awarded the baccalaureate degree "With Honors".

b. Any student who graduates with a rating of 4.5 (3.5, new system) or better, for the entire period of study at L.T.I. shall be awarded the baccalaureate degree "With High Honors".

c. The highest ranking student in each graduating class who graduates with a rating of 4.8 (3.8, new system), or better, and who has completed at least six semesters of work at L.T.I. shall be awarded the baccalaureate degree "With Highest Honors".

THE AIR FORCE ROTC UNIT

An Air Force Reserve Officers Training Corps unit was established at the Lowell Textile Institute on July 1, 1951. Instruction began with the opening of the first semester of the academic year 1951-52.

By vote of the Board of Trustees, all able-bodied male students enrolling in Lowell Textile Institute for the first time on or after September 13, 1951 must satisfactorily complete the basic ROTC work (freshman and sophomore years) before receiving a Bachelor of Science degree. The President of the Institute may waive this requirement and permit the substitution of an equivalent amount of work only for those individuals who are not liable to military service under existing laws and regulations (for example, not a citizen of the United States, previous military service, etc.).

Uniforms and all equipment and textbooks required for the ROTC work will be supplied by the United States Air Force. Students in the Advanced Course will receive the standard cash payment allowed by the Air Force in lieu of subsistence.

The Mission and Purpose of the Air Force ROTC Unit at the Lowell Textile Institute

The mission of the AF-ROTC unit is to develop in each cadet those attributes essential to his progressive advancement to a commission as a Second Lieutenant in the United States Air Force Reserve and further, to prepare him to fill positions of increasing responsibility as a commissioned officer in such duties in the Air Force as may be required by the national defense effort.

The AF-ROTC program takes into consideration the fact that many of the academic subjects in which Lowell Textile Institute students are enrolled have as much direct relationship to military duties as they have to a civilian career. The courses contained in the AF-ROTC curriculum have been carefully selected to augment those academic subjects. The purpose of this course of instruction, then, is to enhance the otherwise high qualifications of the student with a thorough Air Force background.

GENERAL INFORMATION

The work covered in the first two years is considered as the Basic Course. In addition to exercises in leadership and drill, this work includes classroom instruction in World Political Geography, General Plans for the Defense of the United States, Aerial Navigation, Meteorology, Aerodynamics, and Applied Air Power. As stated above, the satisfactory completion of the Basic Course is a requirement for the Bachelor of Science degree in all courses offered at the Institute. Cadets who satisfactorily complete the Basic Course may apply for the Advanced Course, which leads, upon graduation, to a commission as a Second Lieutenant in the Air Force Reserve.

The Advanced Course, consisting of the last two years of ROTC instruction supplemented by a summer camp, is designed to train the cadet in a specialized area for which the Air Force has a definite requirement. Only those cadets who are selected to receive this training may enroll in the Advanced Course. Two specialized areas of training are offered at Lowell Textile Institute—the General Technical Option and the Armament Option.

The General Technical Option is designed to train the cadet in the methods of operation and procedures used by the technical specialist when functioning as an Air Force Officer. The instruction given in the General Technical Option is aimed toward the utilization of the graduate in a Technical Military Occupational specialty which is in accord with his educational background. Since a strong educational background in the physical sciences and mathematics is required, cadets who are taking any of the degree courses offered at the Institute are qualified to enroll in the General Technical Option.

The Armament Option is designed to train the cadet to fulfill the duties of an Armament Officer with the Air Force. These duties require an extensive knowledge of the various types of armament used by the Air Force, such as guns, rocket launchers, bombing and fire-control systems, guided missiles, and pilotless aircraft. Since an engineering background is required to master the subject readily, enrollment in the Armament Option is limited to only those cadets who registered in one of the strictly engineering curricula of the Institute, i.e., Textile Engineering (either Engineering or General Manufacturing Option), Leather Engineering or Paper Engineering.

In addition to completing satisfactorily the subjects required in one of these options, each cadet enrolled in the Advanced Course is required to supplement his training by attending a summer camp of approximately five weeks' duration. Usually, this camp is attended during the summer preceding his senior year. Transportation from the legal residence of the cadet to the camp and return, uniforms, food, lodging, and medical and dental care are provided by the Air Force and, in addition, the cadet receives the pay of a basic Airman.

Upon graduating from the Institute each cadet who has completed satisfactorily the advanced Course of the AF-ROTC will receive a commission as a Second Lieutenant in the United States Air Force Reserve.

Contributions of the AF-ROTC to the Student Life

In addition to the military and academic phases of its program, the Department of Air Science and Tactics sponsors various extra-curricular activities which are designed to produce a well-rounded cadet. Much of this activity will be undertaken by the Arnold Air Society.

Air Force ROTC Review

Military Ball

Review for Honor Cadets

The Arnold Air Society

The Air Force Association sponsors this military fraternity at all colleges that have an AF-ROTC program. The purpose of the Arnold Air Society is to unite selected Advanced AF-ROTC Cadets by a fraternal bond in support of a common cause—the Air Age. A chapter of this society has been established at this Institute. The Arnold Air Society is responsible for a cadet sport program and a variety of social affairs during the academic year, culminating in a military week-end which features a colorful drill ceremony and has as its climax the formal Military Ball. One of the outstanding events of the Military Ball is the naming of the Honorary Cadet Officers.

Periodically, the Department of Air Science and Tactics conducts field trips to various Air Force installations for the purpose of orientation. They frequently include range firing and conducted tours of the base. Sometimes, a familiarization flight is added. Efforts are made also to assist those cadets who are interested in flying to gain as much information as possible about the operational phase of the Air Force.

The AF-ROTC Rifle Team is a member of the National Rifle Association and the New England College Rifle League. In addition to competing in a full schedule of intercollegiate rifle matches, the team competes each year against all of the AF-ROTC units in the First Air Force for the FIRST AIR FORCE TROPHY and all of the AF-ROTC units in the nation for the WILLIAM RANDOLPH HEARST TROPHY.

The AF-ROTC Band is composed primarily of cadets who are musicians or who desire to learn to play a band instrument. In addition to providing the music for the ROTC ceremonies, the band adds considerably to the color and life of the campus by participating in various Institute and civic programs.

Cadet Decorations and Awards

A number of medals are awarded to selected cadets and cadet officers at a special Parade and Review held each spring. The Honorary Cadet Colonel and/or her aides present these awards.

Air Force Association Medal—Normally awarded to the outstanding cadet of the senior class on the basis of his military record for the entire four years of the ROTC program. By special arrangements with the Air Force Association, this medal was awarded during the Year 1951-1952 and will be awarded in 1952-1953 to the outstanding cadet of the Institute's ROTC unit.

Alumni Association Medal—Awarded to the most outstanding cadet, regardless of class, for exemplary achievements in academic, military, and extra-curricular activities. This medal is given by the Lowell Textile Institute Alumni Association.

Distinguished Commander Medal—Awarded to a cadet holding the rank of Major or higher for outstanding performance.

Distinguished Squadron Commander Medal—Awarded to a cadet holding the rank of Captain or higher for outstanding performance in leadership and drill.

Distinguished Flight Leader Medals—Awarded to two cadet lieutenants for outstanding performance in leadership and drill.

Distinguished Non-Commissioned Officer Medals—Awarded to the three Cadet Non-Commissioned Officers who have distinguished themselves by their excellence in leadership and drill.

Distinguished Cadet Medals—Awarded to the three cadets of the second-year Basic Course who have distinguished themselves through their work in leadership and drill.

In addition to the above medals all cadets are eligible to compete for the following:

Arnold Air Society Scholarship—A scholarship of $100 is awarded periodically to a selected member of one of the Arnold Air Society Squadrons in the First District. The basis for selection is the financial need of the cadet coupled with his academic and military record.

Distinguished Military Graduates—Each year certain AF-ROTC graduates are selected to receive this honor. The bases of selection are:

(a) Qualities of military leadership.

(b) High moral character.

(c) Aptitude for military service.

(d) Excellence in academic standing and/or outstanding leadership in campus activities.

A Distinguished Military Graduate may be offered a commission as a Second Lieutenant in the United States Air Force.

M.I.T.-L.T.I. COOPERATIVE PLAN

A cooperative plan of operation between these two institutions has been agreed upon. The major provisions include: (1) the mutual use of the facilities for research and manufacturing in Lowell Textile Institute and the Massachusetts Institute of Technology, Textile Division, for student theses, both graduate and undergraduate; (2) the mutual use of the textile libraries of both institutions; (3) the opportunity, open to students in each institution, to supplement their education by taking work available in the other; (4) the formation of joint seminars and the exchange of staff members for special lectures; and (5) frequent student visits and joint meetings of student societies.

THE INDUSTRIAL TRAINING PROGRAM

The Lowell Textile Institute has established an Industrial Training Program for its undergraduates.

With the assistance of interested industry, the Institute will strive to place every qualified underclassman who wishes industrial training.

The objectives of the Program are four-fold:—

(a) To help supply the much needed work experience to the undergraduate.

(b) To supply an experience in Human Engineering which can only be obtained in industry.

(c) To further the liaison between the Institute and industry.

(d) To supply an employment pool for industry.

Training opportunities will be available in the Paper, Leather, and Textile fields for those students who qualify by not being on scholastic or disciplinary probation.

PLACEMENT OFFICE

The Institute maintains a central placement office which has three functions:

1. To assist in the placement of graduating students.

2. To assist in the up-grading of alumni and/or to help each alumnus attain a position yielding a maximum of satisfaction and happiness.

3. To assist industry in the increasingly difficult job of locating trained and experienced personnel.

The Placement Office is concerned solely with positions affecting the graduating student; it does not attempt to place undergraduates in part-time or summer employment.

4. Administration of the Industrial Training Program.

THE GRADUATE SCHOOL

By act of the General Court of 1935, authority was given to Lowell Textile Institute to confer degrees of Master of Science in Textile Chemistry, Master of Science in Textile Engineering, and Master of Science in Textile Manufacturing to graduate students who satisfactorily complete a program of advanced standing. Recently, authority has been granted to include Master of Science work in the fields of Paper Engineering and of Leather Engineering which will lead to corresponding degrees.

The graduate programs of study offered by the Institute provide for advanced specialized training required by technologists who contribute to industrial progress and human welfare through the application of scientific and engineering principles to existing industrial and human problems. The courses of study allow the graduate of the Institute or of other colleges training men in textile, paper, or leather technology to broaden his knowledge and skills in these areas and to develop a sound research approach to problems of the basic sciences, the development of new products, and industrial production.

I. Admission to the Graduate School

A. *General Admission*

To be eligible for admission to the Graduate School, an applicant must have received a Bachelor's degree in an acceptable four-year course in which he has maintained a uniformly high scholastic rating. Both quality and quantity of the previous training will be considered. Selection of those applicants admitted will be based as far as possible on their ability to pursue graduate work of high quality.

B. *As a Provisional Graduate Student*

An applicant for admission to the Graduate School who is unable to meet all the requirements specified in (I) may be accepted provisionally, provided he satisfies the department in which he wishes to enroll that he is probably able to pursue graduate studies successfully.

The status of such a student will be changed to that of a graduate student upon demonstration of his ability to pursue graduate studies successfully as measured by the completion of his first academic year's work with an average rating of 2.5 (80%).

C. *Application Procedure*

Those wishing to carry on graduate studies at this Institute should file application with the Director of the Graduate School. Applications may be obtained from the Office of the Graduate School.

Applications for admission should be complete and accurate and must be received not later than the fifteenth of April preceding the fall term in which the applicant wishes to enroll. Applications must be supported by letters from at least two persons qualified to judge the ability of the applicant to carry on graduate work and research. The letters should be sent directly from these persons to the Graduate School.

Transcripts of all undergraduate records (and graduate, if any) must be sent directly to the Office of the Graduate School by the institutions which the applicant has previously attended. All transcripts must be official, with appropriate seals and signatures. Records, descriptions and subjects, and letters must be in English. Each subject must be described in terms of content, scope, number of hours per week, and number of weeks duration. Lecture and laboratory time should be properly distinguished.

Except in unusual circumstances, applications will be acted upon and the applicant notified of the decision by June 1, following the receipt of the application.

II. Graduate Courses Offered

Graduate work is offered in the fields of Textile Chemistry, Textile Engineering, Textile Manufacturing, Paper Engineering and Leather Engineering. For the academic year 1953-1954, there will be only a limited amount of graduate work in Textile Manufacturing and no work in Paper or Leather Engineering.

Because of the varied objectives of the graduate student, the course of study is arrived at through consultation with the student's graduate advisor.

III. Term of Residence

Applicants with a sufficient background in their chosen field of concentration will normally require one academic year of residence to complete the requirements for the Master's degree. Those with no background will require a minimum of two years of residence.

IV. Requirements for Graduation

To be recommended for the Master of Science degree a student must have fulfilled the following requirements:

a. Completed a course of study approved by the department in which he has been enrolled.

b. Completed a thesis (original research or other investigation, optional with department) approved by the department in which he has been enrolled.

c. Residence of at least one academic year.

d. An average rating of 2.5 (80%) in those subjects submitted for graduate credit. Those subjects submitted for graduate credit, which are normally upper-class undergraduate subjects (those offered to junior and/or senior students) must be passed with a grade of 80% or better.

The exact nature of each student's program will be worked out in co-operation with the major professor and approved by the Head of the Department. Every attempt will be made to keep such programs flexible and in keeping with the student's educational objectives.

Inquiries on graduate studies should be addressed to Dr. Chapin A. Harris, Director of the Graduate School.

For tuition and fees see Student Expenses on Page 27.

COURSES OF STUDY

Lowell Textile Institute offers ten curricular options leading to the degree of Bachelor of Science. The first semester of the first year's work is common to all curricula. With the start of the second semester of the first year, the student is permitted to undertake a limited amount of specialized work in his chosen field. However, for the first two years the instruction given in all curricula is sufficiently concentrated on fundamentals so that a student may change from one curriculum to another with a minimum loss of time.

Each of the ten curricula is presented in outline form on the following pages. Shown for each semester are the required subjects, the credit-hour value of each subject, and the total credit-hour load. *In general one credit hour represents one hour of lecture-recitation work or approximately three hours of laboratory work.* A description of each subject will be found in the section "Subject Descriptions" in which the subject fields are listed alphabetically.

FIRST YEAR, FIRST SEMESTER (common to all curricula)

				Credit Hours
Chem.	101	General Inorganic Chemistry	(4-3)	5
Eng.	111	Engineering Drawing	(0-6)	2
Engl.	101	English Composition and Literature	(3-0)	3
Math.	103	College Mathematics	(3-0)	3
Phys.	101	Physics	(4-1)	4½
		Orientation	(1-0)	0
		Physical Education	(0-1)	0
A.S.	101	Basic ROTC	(2-1)	2
		or		
S. Sci.	101	World Economic Geography	(2-0)	2
		and		
		Physical Education	(0-1)	0
			Total	19½

COURSE I—COTTON MANUFACTURE

The Cotton Manufacturing curriculum is intended for students contemplating a career in the manufacture of cotton textiles or of textiles produced from any staple fibre utilizing the cotton system of fiber manipulation.

Since cotton itself is the most important textile fiber in terms of domestic and world-wide consumption, it is the policy of this course first to give the student a thorough course of instruction in handling cotton. Later, the adaptation of cotton machinery to process rayon, wool, and other staple fibers is considered. Further, the student is given some orientation to other basic manufacturing systems (wool, filament) in order to develop a well-rounded textile viewpoint.

Around the core of manufacturing subjects there is built an educational background in engineering, science, liberal arts, and business administration aimed at giving the student a broad, versatile basis for assuming his responsibilities in industry and society.

Laboratory work consists of a series of experiments planned to give the student a good acquaintance with the equipment and its use for spinning, weaving, and finishing cotton materials. Most of the laboratory equipment is

full-sized commercial machinery such as the graduate will meet in his industrial experience. Laboratory work is generally synchronized with the lectures to demonstrate and supplement lecture instruction.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Cot.	201	Cotton Carding	(3-2)	4
Cot.	211	Cottons	(1-6)	3
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
				21

*Alternate for ROTC

Des.	261	Color	(1-1)	1

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	202	Cotton Carding	(3-2)	4
Cot.	222	Cot. Waste Proc.	(1-6)	3
Des.	222	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Des.	112	Handloom Weaving	(0-3)	1
Des.	122	Perspective	(0-2)	1

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	301	Cot. Spinning	(2-3)	3
Cot.	311	Staple Fib. Mfr.	(1-2)	1½
Des.	223	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Tex.	311	Textile Testing	(2-2)	3
Weav.	211	Weav. for Mfrs.	(2-2)	2½
Wool	311	Surv. of Wool Mfrs.	(3-1)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Cot.	302	Cotton Spinning	(2-3)	3
Cot.	322	Cot. Qual. Control	(1-2)	1½
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	212	Weav. for Mfrs.	(2-2)	2½
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Engl.	202	Speech	(2-0)	2
Engl.	212	Business English	(1-0)	1

Fourth Year

First Semester

Cot.	401	Mill Organization	(4-0)	4
Cot.	411	Major Project		1
Eco.	351	Textile Marketing	(2-0)	2
Fin.	421	Cot. & Synth. Fin.	(3-3)	4
Knit.	401	Knitting	(2-5)	4
Weav.	311	Weav. for Mfrs.	(2-2)	2½
**Electives				4
				21½

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
Cot.	411	Major Project		4

Second Semester

Cot.	402	Management Prob.	(2-0)	2
Cot.	412	Major Project		6
Eco.	412	Indus. Management	(3-0)	3
Fin.	422	Cot. & Synth. Fin.	(0-3)	1
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
Weav.	312	Weav. for Mfrs.	(2-2)	2½
**Electives				4
				20

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Cot.	412	Major Project		4

COURSE II—WOOL MANUFACTURE

The course in Wool Manufacturing is planned for students who contemplate a career in the industries utilizing the wool fiber, or using the woolen, worsted, or felt systems of machinery to process fibers of any type. The student studies all fibers and all basic processing systems, but emphasis is given to the wool fiber and its manufacture. Instruction is also given in both lectures and laboratory on the reprocessing of fibers, rag-picking, and garnetting. Through the use of the Pacific Converter the processing of synthetic tow to top and yarns is studied. The latest equipment for superdraft drawing and spinning, a Holdsworth Gill Reducer, a Warner-Swasey Pin Drafter, and other modern equipment is available for laboratory work.

The purpose of the Wool Manufacturing course is to train students for executive positions in any of the branches of the wool industry. It is planned for those who are chiefly interested in the production and processing phases. A thorough engineering and scientific background is part of the course in order to enable the student to understand better the application of engineering principles as applied to both textile machines and processes.

A maximum amount of time is devoted to the professional or textile subjects. Laboratory experiments are planned to train the student in the method of analyzing machines, as well as tests, settings, adjustments and the elimination of faulty work. With wool now being manufactured on cotton machinery, a study in Survey of Cotton Manufacture is offered in order that the student may know the similarities and differences of the wool and cotton systems. Synthetic fiber processing in the woolen and worsted systems is studied and laboratory work includes the actual processing of staple rayon and other manufactured fibers alone or blended with wool. Courses in economics, speech, business administration, labor problems, etc., are offered to prepare better the student to assume a position of responsibility and leadership, both in the industry and in his community.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	102	Elem. Tex. Des.	(2-1)	2
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Physical Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Physical Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Des.	232	Fabric Des. & Anal. for Mfrs.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
Weav.	211	Weaving for Mfrs.	(2-2)	2½
Wool	211	Top Making	(2-6)	4
				20½

*Alternate for ROTC

S.Sci.	461	Personnel Mgmt.	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Des.	233	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
Weav.	212	Weaving for Mfrs.	(2-2)	2½
Wool	212	Top Making	(2-6)	4
				20½

*Alternate for ROTC

Eng.	122	Machine Tool Lab.	(1-2)	1
		or		
S. Sci.	212	World History since 1900	(3-0)	3

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Engl.	311	Business English	(1-0)	1
Tex.	311	Textile Testing	(2-2)	3
Weav.	311	Weav. for Mfrs.	(2-2)	2½
Wool	301	Woolen Yarns	(2-4)	3½
Wool	321	Worsted Yarns	(3-5)	5
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	301	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	221	Eco. Hist.; the U.S.	(3-0)	3

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	312	Weav. for Mfrs.	(2-2)	2½
Wool	302	Woolen Yarns	(2-4)	3½
Wool	322	Worsted Yarns	(3-3)	4
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	302	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Engl.	222	Apprec. of Lit.	(3-0)	3

Fourth Year

Eco.	341	Accounting I	(3-0)	3
Eco.	351	Textile Marketing	(2-0)	2
Engl.	201	Speech	(2-0)	2
Fin.	401	Wln. & Wstd. Fin.	(2-3)	3
Knit.	403	Knitting	(2-3)	3
Wool	411	Woolen Mill Organ.	(4-0)	4
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	401	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Cot.	332	Cot. Yarn Mfg. Sur.	(3-1)	3
Eco.	412	Ind. Management	(3-0)	3
Eng.	212	Heat and Power	(2-2)	3
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Fin.	402	Wln. & Wstd. Fin.	(2-3)	3
Syn.	322	Fil. Yarn Proc. Sur.	(2-0)	1½
**Electives				3 or 4
				18½ or 19½

**Electives restricted to

A.S.	402	Adv. ROTC General Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	302	Mod. Labor Prob.	(3-0)	3

COURSE III—TEXTILE DESIGN

The prescribed curriculum of the Textile Design Course is especially planned to equip the student with the fundamentals of structural textile design. This type of designing of textiles is concerned with the building of a fabric. To this end the student should become fully conversant, through lectures and laboratory work, with the properties of natural and synthetic fibers, the different systems of yarn manufacture, various arrangements of yarns in fabrics, the methods used to execute designs in woven and knitted fabric, dyeing, the various finishing processes employed after fabrication, and the methods used for testing fabrics.

Emphasis is placed on subjects dealing with the analysis and designing of fabric structures, from the simplest plain fabric to the more complicated and elaborate. The broad scope of this curriculum provides, in addition to the more specific structural design objectives, subjects in the sciences, liberal arts, and management.

The graduate of the Textile Design Course, though more specifically equipped as a structural textile designer, is qualified to enter into other branches of the textile industry according to his aptitudes and opportunities.

A new approach combining textiles and fashions is part of the Design Department plan. This course will be offered if a sufficient number of interested applicants are accepted. The proposed curriculum is available upon request.

First Year

First Semester					*Second Semester*			
Refer to Page 45					*A.S.	102	Basic ROTC	(2-1) 2
					Chem.	102	Gen. Inorg. Chem.	(3-3) 4
					Des.	104	Yarn Calculation	(1-0) 1
					Des.	106	Elem. Tex. Des.	(3-1) 3
					Des.	112	Handloom Weav.	(0-3) 1
					Eng.	104	Mechanism	(2-0) 2
					Eng.	114	Eng. Drawing	(0-3) 1
					Engl.	102	Engl. Comp. & Lit.	(3-0) 3
					Math.	104	College Math.	(3-0) 3
							Orientation	(1-0) 0
							Phys. Ed.	(0-1) 0
								20
					*Alternate for ROTC			
					S.Sci.	102	World Eco. Geog.	(2-0) 2
							Phys. Ed.	(0-1) 0

Second Year

*A.S.	201	Basic ROTC	(2-1) 2	*A.S.	202	Basic ROTC	(2-1) 2
Des.	203	Tex. Des. & Fab. Anal.	(3-2) 4	Des.	204	Tex. Des. & Fab. Anal.	(3-2) 4
Des.	251	Color	(1-1) 2	Des.	252	Color	(1-1) 2
Eco.	201	Economics	(3-0) 3	Eco.	202	Economics	(3-0) 3
Math.	211	Mathematics	(3-0) 3	Math.	212	Mathematics	(3-0) 3
Phys.	201	Physics	(3-2) 4	Phys.	202	Physics	(3-2) 4
Weav.	201	Weaving	(2-4) 3½	Weav.	202	Weaving	(2-4) 3½
			21½				21½
*Alternate for ROTC				*Alternate for ROTC			
Engl.	201	Speech	(2-0) 2	Des.	121	Perspective	(0-2) 1
				Engl.	212	Business English	(1-0) 1

Third Year

Chem.	221	Int. to Tex. Chem.	(2-0) 2	Chem.	222	Int. to Tex. Chem.	(1-3) 2
Cot.	331	Cot. Yarn Mfr. Sur.	(3-1) 3	Des.	302	Tex. Des. & Fab. Anal.	(2-2) 3
Des.	301	Tex. Des. & Fab. Anal.	(2-2) 3	Des.	314	Tex. Des. & Fab. Anal.	(2-2) 3
Des.	313	Tex. Des. & Fab. Anal.	(2-2) 3	Tex.	302	Fabrics	(3-0) 3
Eco.	341	Accounting I	(3-0) 3	Weav.	302	Weaving	(2-4) 3½
Weav.	301	Weaving	(2-4) 3½	Wool	312	Sur. of Wool Mfr.	(3-1) 3
**Electives			3 or 4	**Electives			3 or 4
			20½ or 21½				20½ or 21½
**Electives restricted to				**Electives restricted to			
A.S.	301	Adv. ROTC General Tech. Option	(4-1) 4	A.S.	302	Adv. ROTC General Tech. Option	(4-1) 4
A.S.	303	Adv. ROTC Armament Option	(4-1) 4	A.S.	304	Adv. ROTC Armament Option	(4-1) 4
S.Sci.	311	Psychology	(3-0) 3			A Social Science elective	(3-0) 3

Fourth Year

Des.	403	Tex. Des. & Fab. Anal.	(2-2) 3	Des.	404	Tex. Des. & Fab. Anal.	(2-2) 3
Des.	411	Jacquard Des. & Weav.	(1-2) 2	Des.	406	Adv. Tex. Des. & Anal.	(2-1) 2
Eco.	351	Textile Marketing	(2-0) 2	Fin.	412	Woolen & Wstd. Fin.	(3-3) 4
Fin.	431	Cot. & Syn. Fin.	(3-3) 4	Syn.	322	Fil. Yarn Proc. Sur.	(2-0) 1½
Knit.	403	Knitting	(2-3) 3	S.Sci.	302	Mod. Labor Prob.	(3-0) 3
Tex.	311	Textile Testing	(2-2) 3	Tex.	312	Textile Testing	(2-2) 3
**Electives			3 or 4	**Electives			3 or 4
			20 or 21				19½ or 20½
**Electives restricted to				**Electives restricted to			
A.S.	401	Adv. ROTC General Tech. Option	(4-1) 4	A.S.	402	Adv. ROTC General Tech. Option	(4-1) 4
A.S.	403	Adv. ROTC Armament Option	(4-1) 4	A.S.	404	Adv. ROTC Armament Option	(4-1) 4
S.Sci.	301	Mod. Eco. Prob.	(3-0) 3	Eco.	412	Ind. Management	(3-0) 3

COURSE IV—CHEMISTRY, TEXTILE COLORING, AND FINISHING

This curriculum is designed to train those who wish to engage in the bleaching, scouring, dyeing, printing, and finishing of textiles, or who are interested in the manufacture, demonstration, and sale of dyestuffs, detergents, and other chemicals used in the textile industry. Students having difficulty in color perception, while unfitted for employment in dyehouses or with dyestuff concerns, are capable of having a successful career in other branches of Textile Chemistry.

This course provides a basic training in chemistry, physics, and mathematics. To this is added theoretical and practical training in bleaching, dyeing, printing and finishing, given in the junior and senior years. Since it is assumed that the students will eventually have executive or supervisory positions, they are required to take courses in English and speech to provide a background for report writing and the expression of ideas. Courses in the humanities are also required in the hope that with a broader training the graduate will become a more valuable member of his community as well as a success in his chosen profession. German is offered students intending to study for advanced degrees.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	104	Gen. Inorg. Chem.	(3-0)	3
Chem.	122	Qual. Analysis	(1-6)	3
Chem.	124	Elem. Stoich.	(2-0)	2
Eng.	104	Mechanism	(2-0)	2
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
Wool	112	Surv. of Wool Mfrs.	(2-0)	2
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Elem. Org. Chem.	(3-3)	4
Chem.	211	Quant. Analysis	(1-6)	3
Chem.	241	Stoichiometry	(1-0)	1
Cot.	231	Cot. Yn. Mfg. Surv.	(2-0)	2
Math.	203	Math. for Chem.	(4-0)	4
Phys.	201	Physics	(3-2)	4
				20

*Alternate for ROTC

Ger.	201	Tech. German	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Elem. Org. Chem.	(3-3)	4
Chem.	204	Chem. Tech. of Fibers	(2-0)	2
Chem.	212	Quant. Analysis	(1-6)	3
Chem.	242	Stoichiometry	(1-0)	1
Math.	204	Math. for Chem.	(4-0)	4
Phys.	202	Physics	(3-2)	4
				20

*Alternate for ROTC

Ger.	202	Tech. German	(3-0)	3

Third Year

First Semester

Chem.	311	Tex. Quant. Anal.	(1-3)	2
Chem.	321	Textile Chemistry	(2-3)	3
Chem.	331	Phys. Chemistry	(3-1½)	3½
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Tex.	311	Textile Testing	(2-2)	3
**Electives				4 to 6
				20½ to 22½

**Electives (select 4 to 6 cr. hrs.)

A.S.	301 or 303	Adv. ROTC	(4-1)	4
Chem.	333	Indus. Stoich.	(3-0)	3
Chem.	473	At. & Mol. Struct.	(2-0)	2
Eng.	351	Expl. Appl. of Statistics	(3-0)	3
Ger.	201	Tech. German	(3-0)	3

Second Semester

Chem.	322	Textile Chemistry	(2-3)	3
Chem.	332	Phys. Chemistry	(3-3)	4
Chem.	362	Gen. Colloid Chem.	(2-0)	2
Eco.	202	Economics	(3-0)	3
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
**Electives				4 to 6
				21 to 23

**Electives (select 4 to 6 cr. hrs.)

A.S.	302 or 304	Adv. ROTC	(4-1)	4
Chem.	312	Tex. Quant. Anal.	(1-3)	2
Chem.	342	Org. Qual. Anal.	(1-3)	2
Chem.	352	Chem. Eng.	(3-0)	3
Ger.	202	Tech. German	(3-0)	3

Note: Ger. 201 must be followed by Ger. 202.

Fourth Year

Chem.	411	Adv. Tex. Chem. & Dyeing	(2-9)	5
Chem.	431	Macromol. Chem. of Tex. Proc.	(2-0)	2
Fin.	411	W. & W. Fin.	(3-3)	4
Eco.	351	Tex. Marketing	(2-0)	2
		or		
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3
**Electives				6
				19 or 20

**Electives

A.S.	401 or 403	Adv. ROTC	(4-1)	4
		Tech. or Prof. subjects as approved by the Dept. Head		2 to 6

Chem.	412	Adv. Tex. Chem. & Dyeing	(2-9)	5
Chem.	422	Adv. Chem. Tex. Test.	(2-3)	3
Fin.	432	Cot. & Syn. Fin.	(3-3)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
**Electives				6
				21

**Electives

A.S.	402 or 404	Adv. ROTC	(4-1)	4
		Tech or Prof. subjects as approved by the Dept. Head		2 to 6

COURSE V—SYNTHETIC TEXTILES

This curriculum is designed for students interested in those segments of the textile industry primarily devoted to the utilization of man-made fibers, with particular emphasis on continuous filament fibers. Silk, being a natural continuous filament fiber not covered in other manufacturing courses, is also considered.

The synthetic fiber phase of textiles is the most recent addition to the industry and found its origin in the various chemical research laboratories. Because of this, an understanding of the manufacture and utilization of synthetic fibers depends upon a sound training in chemistry, physics and mathematics. More emphasis is placed on chemistry than in the other manufacturing courses.

Realizing the importance of a broad college training for men entering the industry with the intention of eventually assuming some type of administrative position, specialization in textiles is limited to approximately forty percent of the total credit hour load. The remaining sixty percent of the studies are devoted to basic subjects, such as the fundamental physical sciences, English, the social sciences, and economics. Within the broad field of specialization in textiles, about one-half of the time is devoted to synthetic fibers, yarns, and textiles.

Graduates of this curriculum should be acceptable to the textile manufacturer, the synthetic fiber producer, and the graduate schools of the country.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	103	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19

*Alternate for ROTC

S.Sci.	102	World Econ. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Org. Chem.	(3-3)	4
Chem.	221	Int. to Tex. Chem.	(2-0)	2
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
				20
*Alternate for ROTC				
S.Sci.	223	The U. S. since 1865	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Organic Chem.	(3-3)	4
Chem.	222	Int. to Tex. Chem.	(1-3)	2
Des.	222	Fab. Des. & Anal.	(2-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
				20
*Alternate for ROTC				
Engl.	222	Appr. of Lit.	(3-0)	3
S.Sci.	212	World History	(3-0)	3

Third Year

Des.	308	Syn. Fab. Des. & Anal.	(1-2)	2
Syn.	301	Fil. Yarn Proc.	(2-0)	2
Syn.	311	Mfr. of Syn. Fibers	(3-0)	3
Syn.	331	Fil. Yarn Lab.	(0-3)	1
Tex.	311	Textile Testing	(2-2)	3
Weav.	211	Weaving for Mfrs.	(2-2)	2½
Wool	311	Surv. of Wool Mfr.	(3-1)	3
**Electives				3 or 4
				19½ or 20½
**Electives restricted to				
A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Cot.	332	Cot. Yn. Mfr. Surv.	(3-1)	3
Syn.	302	Throwing Plt. Org.	(2-0)	2
Syn.	312	Str. & Prop. of Syn. Fibers	(3-0)	3
Syn.	332	Fil. Yn. Lab.	(0-3)	1
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	212	Weaving	(2-2)	2½
**Electives				3 or 4
				19½ or 20½
**Electives restricted to				
A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

Fourth Year

Eco.	351	Textile Marketing	(2-0)	2
Eng.	431	Adv. Phys. Testing	(1-3)	2
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Knit.	403	Knitting	(2-3)	3
Syn.	411	Prop. & Appl. of Syn. Fibers	(3-0)	3
Weav.	311	Weav. for Mfrs.	(2-2)	2½
**Electives				3 or 4
				19½ or 20½
**Electives restricted to				
A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	311	Psychology	(3-0)	3
S.Sci.	321	Comp. Mod. Govts.	(3-0)	3
S.Sci.	461	Personnel Mgmt.	(3-0)	3

Eco.	412	Indus. Management	(3-0)	3
Engl.	202	Speech	(2-0)	2
S.Sci.	314	Phil. of Science	(3-0)	3
Syn.	412	Prop. & Appl. of Syn. Fibers	(3-0)	3
Syn.	452	Syn. Tex. Seminar	(2-0)	2
Weav.	312	Weaving	(2-2)	2½
**Electives				3 or 4
				18½ or 19½
**Electives restricted to				
A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Eco.	344	Prin. of Sel. & Adv.	(3-0)	3
Phys.	402	Textile Physics	(2-3)	3
S.Sci.	466	Management Prob.	(3-0)	3

COURSE VI—TEXTILE ENGINEERING

The concept of a textile engineer originated in 1905, and the first known curriculum in Textile Engineering appears in the Lowell Textile Institute catalog for 1905-06. Through the succeeding years the same general pattern has been followed in this training, modified from time to time, however, to recognize changing conditions in the industry and in educational ideas, but always embodying the same two fundamental foundations. A textile engineer is defined as one who has had a basic training in engineering to which has been added a thorough grounding in the manufacture of textiles, their properties and uses.

Two options are offered in Textile Engineering, viz., Engineering and General Manufacturing. It is the belief of the Engineering faculty and administration at Lowell Textile Institute that except in certain highly specialized areas, e.g.,

chemistry, the ideal training for the textile industry combines an understanding of textile processing relating to all fibers, a sound engineering and scientific background, as well as an orientation to society and business through a selected core of liberal arts and economic subjects. Although the credit hour ratings, assigned to VI-E and VI-G are somewhat above the average, experience has shown that they are within the capacity of the student of serious intent who really desires the broad training they provide.

ENGINEERING OPTION—VI-E

The Engineering Option provides a training in Mechanical Engineering similar to that found in other engineering schools. To this is added a knowledge of Textiles sufficient to prepare the individual for positions in the textile and allied industries which may involve research and engineering principles. Business subjects and the humanities are included in the curriculum so that this type of textile engineer may have the educational potential to rise to a position of executive responsibility.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19
*Alternate for ROTC				
S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

*A.S.	201	Basic ROTC	(2-1)	2
Des.	101	Elem. Tex. Des.	(2-1)	2
Des.	103	Yarn Calculation	(1-0)	1
Eng.	201	Mach. Drawing	(0-3)	1
Eng.	221	Tex. Mechanism	(1-2)	1½
Eng.	233	Mach. Tool Lab.	(0-3)	1
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
Wool	311	Surv. of Wool Mfr.	(3-1)	3
				19½
*Alternate for ROTC				
Engl.	201	Speech	(2-0)	2
Engl.	211	Business English	(1-0)	1

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	332	Cot. Yn. Mfr. Surv.	(3-1)	3
Des.	224	Fab. Des. & Anal. for Engrs.	(2-1)	2
Des.	234	Fab. Des. & Anal. for Engrs.	(2-1)	2
Eng.	222	Applied Mechanics	(3-0)	3
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
				20½
*Alternate for ROTC				
Engl.	222	Apprec. of Lit.	(3-0)	3
		or		
S.Sci.	212	World History since 1900	(3-0)	3

Third Year

Eco.	201	Economics	(3-0)	3
Eng.	301	Adv. Appl. Mech.	(3-0)	3
Eng.	331	Mill Engineering		
		or	(3-0)	3
Eng.	351	Expl. Appl. of Statistics		
Phys.	321	Electronics	(3-2)	4
Tex.	311	Textile Testing	(2-2)	3
Weav.	333	Weav. for Engrs.	(1-2)	1½
**Electives				3 or 4
				20½ or 21½
**Electives restricted to				
A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		3

Eng.	302	Adv. Appl. Mech.	(3-0)	3
Eng.	312	Heat Engineering	(3-2)	4
Eng.	342	Prin. of El. Eng.	(3-2)	4
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
**Electives				3 or 4
				20½ or 21½
**Electives restricted to				
A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Eco.	202	Economics	(3-0)	3

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eng.	401	Prin. of El. Eng.	(3-2)	4
Eng.	411	Adv. Ht. Eng.	(2-2)	3
Eng.	425	Eng. Des. of Tex. Structures	(2-0)	2
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Eng.	431	Adv. Phys. Test. *or*	(1-3)	2
Phys.	401	Tex. Microscopy		
**Electives				3 or 4
				21 or 22

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Eco.	412	Indus. Management	(3-0)	3
Eng.	402	Tex. Appl. of Elec.	(1-4)	1
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Eng.	426	Eng. Des. of Tex. Structures	(2-0)	2
Fin.	412	W. & W. Finishing	(3-3)	4
Knit.	404	Knitting *or*	(2-3)	3
Eng.	424	Machine Design *or*	(2-2)	3
Math.	402	Diff. Equations *or*	(3-0)	3
Phys.	402	Tex. Physics	(2-3)	3
**Electives				3 or 4
				18 or 19

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

GENERAL MANUFACTURING OPTION—VI-G

The objective of the General Manufacturing Option is to provide the textile industry with technically trained textile engineers. The curriculum has been planned so that the textile engineer (1) shall be given as complete and thorough a knowledge and understanding of the raw materials, machines, and processes peculiar to the manufacture of all fibers as is possible; (2) shall have a basic training in engineering and the fundamental sciences; and (3) shall acquire a knowledge of business and managerial principles and the social sciences.

The first component should prepare the student to be useful in any textile plant regardless of fiber processed. The second should develop a man who will approach textile problems from an engineering viewpoint thus contributing toward their solution the benefits of a trained analytical mind. Third objective should aid in the production of a well-rounded individual.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	112	Eng. Drawing	(0-6)	2
Eng.	122	Mach. Tool Lab.	(1-2)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Cot.	201	Cotton Carding	(3-2)	4
Des.	101	Elem. Tex. Des.	(2-1)	2
Eco.	201	Economics	(3-0)	3
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
Wool	215	Top Making	(2-2)	3
				22

*Alternate for ROTC

Weav.	221	Weav. for Engrs.	(2-0)	2

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Cot.	202	Cotton Carding	(3-2)	4
Des.	224	Fab. Des. & Anal. for Engrs.	(2-1)	2
Des.	234	Fab. Des. & Anal. for Engrs.	(2-1)	2
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
Wool	216	Top Making	(2-2)	3
				21

*Alternate for ROTC

Weav.	222	Weav. for Engrs.	(2-0)	2

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	303	Cotton Spinning	(2-2)	3
Eng.	321	Str. of Mat.	(3-0)	3
Phys.	321	Electronics	(3-1)	3½
Tex.	311	Textile Testing	(2-2)	3
Weav.	333	Weav. for Engrs.	(1-2)	1½
Wool	323	Woolen Yarns	(2-2)	2½
		or		
Wool	325	Worsted Yarns	(3-2)	3½
**Electives				4
				22½ or 23½

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Cot.	304	Cotton Spinning	(2-2)	3
Eng.	344	Elec. Machinery	(3-2)	4
Tex.	302	Fabrics	(2-0)	2
Tex.	312	Textile Testing	(2-2)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
Wool	324	Woolen Yarns	(2-2)	2½
		or		
Wool	326	Worsted Yarns	(3-2)	3½
**Electives				4
				22 or 23

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Fourth Year

First Semester

Cot.	401	Mill Organization	(4-0)	4
Eco.	341	Accounting I	(3-0)	3
Eng.	403	Prin. of Ht. Eng.	(3-2)	4
Fin.	431	Cot. & Syn. Fin.	(3-3)	4
Eng.	431	Adv. Phys. Test.		
		or	(1-3)	2
Phys.	401	Tex. Microscopy		
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Eco.	412	Indus. Management	(3-0)	3
Eng.	402	Tex. Appl. of Elec.	(1-4)	1
Eng.	422	Tex. Proc. Instr.	(2-0)	2
Engl.	212	Business English	(1-0)	1
Fin.	412	W. & W. Finishing	(3-3)	4
Knit.	404	Knitting	(2-3)	3
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
**Electives				4 or 5
				19½ or 20½

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Engl.	202	Speech	(2-0)	2
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3

COURSE VII—TEXTILE SALES AND MANAGEMENT

This course is designed for those interested in the marketing and management phases of the textile and allied industries. Its emphasis is on all three branches of management—production, distribution, and finance. The student is given a fundamental knowledge of the natural sciences and their application to the processing of all types of textile fibers. This scientific and manufacturing background is increasingly essential to effective merchandising and management, particularly at the higher levels of supervision. A substantial amount of time is also devoted to cultural subjects designed to broaden the student's outlook, increase his understanding of social and economic problems, and improve his ability to get along with people.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Des.	102	Elem. Tex. Des.	(2-1)	2
Des.	104	Yarn Calculation	(1-0)	1
Eng.	102	Mechanism	(4-0)	4
Eng.	114	Eng. Drawing	(0-3)	1
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Des.	222	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Des.	251	Color	(1-1)	2
Eco.	201	Economics	(3-0)	3
Math.	211	Mathematics	(3-0)	3
Phys.	201	Physics	(3-2)	4
Weav.	333	Weav. for Engrs.	(1-2)	1½
Wool	311	Surv. of Wool Mfr.	(3-1)	3
				20½

*Alternate for ROTC

		Elective approved by Head of Dept.		2

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Des.	223	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Des.	252	Color	(1-1)	2
Eco.	202	Economics	(3-0)	3
Math.	212	Mathematics	(3-0)	3
Phys.	202	Physics	(3-2)	4
S.Sci.	222	Man & His Envir.	(3-0)	3
Weav.	334	Weav. for Engrs.	(1-2)	1½
				20½

*Alternate for ROTC

		Elective approved by Head of Dept.		2

Third Year

First Semester

Chem.	221	Int. to Tex. Chem.	(2-0)	2
Cot.	331	Cot. Yn. Mfg. Surv.	(3-1)	3
Des.	232	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	311	Eco. Statistics	(3-0)	3
Eco.	321	Prin. of Marketing	(3-0)	3
Tex.	311	Textile Testing	(2-2)	3
**Electives				4
				20

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester

Chem.	222	Int. to Tex. Chem.	(1-3)	2
Des.	233	Fab. Des. & Anal. for Mfrs.	(2-1)	2
Eco.	322	Prin. of Marketing	(3-0)	3
Eco.	344	Prin. of Sel. & Adv.	(3-0)	3
S.Sci.	314	Phil. of Science	(3-0)	3
Tex.	312	Textile Testing	(2-2)	3
**Electives				4
				20

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eco.	431	Selling Policies	(3-0)	3
Fin.	431	Cot. & Syn. Fin.	(3-3)	3
S.Sci.	311	Psychology	(3-0)	3
S.Sci.	463	Bus. Law	(3-0)	3
**Electives				4
				20

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

Second Semester

Eco.	342	Accounting II	(3-0)	3
Eco.	412	Indus. Management	(3-0)	3
Fin.	412	W. & W. Finishing	(3-3)	4
S.Sci.	302	Mod. Lab. Prob.	(3-0)	3
Syn.	322	Fil. Yn. Proc. Surv.	(2-0)	1½
**Electives				4
				18½

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
		Elective approved by Head of Dept.		4

COURSE VIII—PAPER ENGINEERING

The object of this course is to fit a man for work in the paper-making, paper-converting, or allied industries. For this, a thorough training in basic chemical engineering is offered, accompanied by instruction in the theory and practice of pulp and paper manufacture and paper converting. Paper engineering involves the application of cellulose and plastics chemistry together with engineering principles to the handling of the material in the web or sheet form, as it is treated, coated, or converted into the final product. Every effort will be made by cooperation with local concerns to supplement college work by experience in actual manufacturing conditions, thus giving the student an opportunity to familiarize himself with equipment commonly in use in the industry.

Students taking this course should be well equipped for work in the paper-making or paper-converting fields, or for graduate study in paper technology.

The curriculum outlined below should be regarded as provisional in character.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	102	Gen. Inorg. Chem.	(3-3)	4
Chem.	112	Qual. Anal.	(2-3)	3
Chem.	124	Elem. Stoich.	(2-0)	2
Eng.	112	Eng. Draw.	(0-6)	2
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	Col. Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				19

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Org. Chem.	(3-3)	4
Chem.	213	Quant. Anal.	(2-6)	4
Math.	201	Math. for Chem.	(4-0)	4
Paper	201	Pulp & Paper Mfr.	(3-0)	3
Phys.	201	Physics	(3-2)	4
				21

*Alternate for ROTC

Ger.	201	Tech. German	(3-0)	3

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Org. Chem.	(3-3)	4
Eng.	104	Mechanism	(2-0)	2
Engl.	202	Speech	(2-0)	2
Math.	202	Math. for Chem.	(4-0)	4
Paper	202	Pulp & Paper Mfr.	(3-0)	3
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Ger.	202	Tech. German	(3-0)	3

Third Year

First Semester

Chem.	331	Phys. Chem.	(3-1½)	3½
Chem.	333	Indus. Stoich.	(3-0)	3
Paper	303	Wood Tech.	(3-3)	4
Phys.	321	Electronics	(3-1)	3½
S.Sci.	221	Eco. History	(3-0)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	301 or			
A.S.	303	Adv. ROTC	(4-1)	4
Eng.	351	Expl. Appl. of Stat.	(3-0)	3

Second Semester

Chem.	332	Phys. Chem.	(3-3)	4
Chem.	352	Chem. Eng.	(3-0)	3
Chem.	362	Gen. Colloid Chem.	(2-0)	2
Engl.	212	Business Engl.	(1-0)	1
Paper	312	Pulp. & Paper Test. & Anal.	(4-7)	6
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	302 or			
A.S.	304	Adv. ROTC	(4-1)	4
Paper	302	Pulp & Paper Mfr.	(3-0)	3

Fourth Year

First Semester

Paper	401	(Practice Work in Industry)		18
**Electives				2 or 4
				20 or 22

**Electives restricted to

A.S.	401 or			
A.S.	403	Adv. ROTC	(4-1)	4
Paper	403	Mat. of Const., Corrosion	(2-0)	2

Second Semester

Chem.	442	Adv. Chem. Eng.	(3-0)	3
Eng.	344	Elec. Machinery	(3-2)	4
Paper	404	Paper Coat. & Conv.	(3-0)	3
S.Sci.	222	Man & His Envir. *or*	(3-0)	3
S.Sci.	314	Phil. of Science		
S.Sci.	302	Mod. Labor Prob.	(3-0)	3
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	402 or			
A.S.	404	Adv. ROTC	(4-1)	4
Paper	414	Adv. Paper Prob.	(1-4)	3

COURSE IX—LEATHER ENGINEERING

The concept of a leather engineer is new to the leather industry. The economic size of this industry as well as the scope and number of its problems warrants the careful training of individuals capable of handling the specific problems which arise in this industry. The leather industry realizes that many of its products can be improved by the application of sound and intelligent research and development. The demand is growing for engineers having a basic understanding of the art of leather manufacturing.

In this curriculum, emphasis will be placed on the fundamentals of engineering, including mathematics, physics, chemistry, and theoretical and applied mechanics. These subjects are basic in any sound undergraduate program. Since the undergraduate student cannnt be left with a great collection of tools which he does not understand, subjects are offered in the application of their basic scientific principles to leather technology. In order to balance properly this program, subjects in general education are offered, since the engineer as well as being trained to be a leader in his profession must also be trained to be a leader in everyday economic, social, and political affairs. He must also be trained to meet success, promotion, and the challenge of directing the work of others.

The curriculum outlined below should be regarded as provisional in character.

First Year

First Semester

Refer to Page 45

Second Semester

*A.S.	102	Basic ROTC	(2-1)	2
Chem.	104	Gen. Inorg. Chem.	(3-0)	3
Chem.	112	Qual. Anal.	(2-3)	3
Chem.	124	Elem. Stoich.	(2-0)	2
Eng.	104	Mechanism	(2-0)	2
Eng.	112	Eng. Drawing	(0-6)	2
Engl.	102	Engl. Comp. & Lit.	(3-0)	3
Math.	104	College Math.	(3-0)	3
		Orientation	(1-0)	0
		Phys. Ed.	(0-1)	0
				20

*Alternate for ROTC

S.Sci.	102	World Eco. Geog.	(2-0)	2
		Phys. Ed.	(0-1)	0

Second Year

First Semester

*A.S.	201	Basic ROTC	(2-1)	2
Chem.	201	Elem. Org. Chem.	(3-3)	4
Chem.	213	Quan. Anal.	(2-6)	4
Engl.	201	Speech	(2-0)	2
Ger.	201	Tech. German	(3-0)	3
Math.	201	Anal. Geom. & Calc.	(4-0)	4
Phys.	201	Physics	(3-2)	4
				23

*Alternate for ROTC

Eng.	201	Machine Drawing	(0-3)	1

Second Semester

*A.S.	202	Basic ROTC	(2-1)	2
Chem.	202	Elem. Org. Chem.	(3-3)	4
Engl.	212	Business English	(1-0)	1
Ger.	202	Tech. German	(3-0)	3
Lea.	202	App. Lea. Anal.	(1-6)	3
Math.	202	Anal. Geom. & Calc.	(4-0)	4
Phys.	202	Physics	(3-2)	4
				21

*Alternate for ROTC

Eng.	222	Applied Mechanics	(3-0)	3

Third Year

First Semester

Chem.	331	Physical Chem.	(3-1½)	3½
Chem.	335	Chem. of the Proteins	(3-0)	3
Eng.	321	Strength of Mater.	(3-0)	3
Lea.	301	Leather Mfr.	(3-6)	5
Lea.	303	Histo-Pathology of Animal Tissues	(1-6)	3
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	301	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	303	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	301	Mod. Eco. Prob.	(3-0)	3

Second Semester

Chem.	332	Physical Chem.	(3-3)	4
Chem.	362	Gen. Colloid Chem.	(2-0)	2
Lea.	302	Leather Mfr.	(3-6)	5
Lea.	304	Micros. in Tanning	(1-3)	2
Lea.	322	Tanning Mechan.	(3-0)	3
**Electives				3 or 4
				19 or 20

**Electives restricted to

A.S.	302	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	304	Adv. ROTC Armament Option	(4-1)	4
Eco.	412	Ind. Management	(3-0)	3

Fourth Year

First Semester

Eco.	341	Accounting I	(3-0)	3
Eng.	351	Exp. App. of Stat.	(3-0)	3
Lea.	401	Leather Mfr.	(3-6)	5
Lea.	411	Leather Problems	(1-6)	3
Phys.	321	Electronics	(3-1)	3½
**Electives				3 or 4
				20½ or 21½

**Electives restricted to

A.S.	401	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	403	Adv. ROTC Armament Option	(4-1)	4
S.Sci.	463	Business Law	(3-0)	3

Second Semester

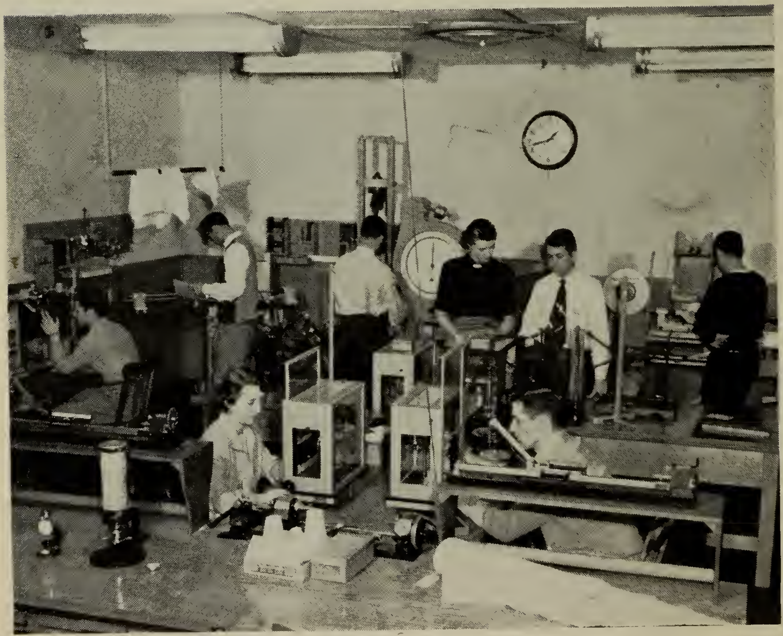
Eco.	468	Financial Mgmt.	(2-0)	2
Eng.	344	Elec. Machinery	(3-2)	4
Lea.	402	Leather Mfr.	(3-6)	5
Lea.	404	Prop. of Leather	(2-3)	3
Lea.	412	Leather Problems	(1-6)	3
**Electives				3 or 4
				20 or 21

**Electives restricted to

A.S.	402	Adv. ROTC Gen. Tech. Option	(4-1)	4
A.S.	404	Adv. ROTC Armament Option	(4-1)	4
Eng.	424	Machine Design	(2-2)	3

NEW PAPER AND LEATHER ENGINEERING BUILDING

Meeting of Students' Chapter of American Association of Textile Chemists and Colorists



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Textile Testing Laboratory

SUBJECT DESCRIPTIONS

1. First semester subjects are those ending in odd numbers.

2. Second semester courses are indicated by even numbers.

3. Subjects continuing throughout the year are indicated by hyphenated numbers.

4. The number of lecture-recitation and laboratory hours is indicated within the parentheses and the credit is shown outside. In the case of a year course, the credit shown is the total for the year. Example: (2-6)4 would mean 2 hours of lecture-recitation and 6 hours of laboratory for 4 credits; while a year course (2-3) (1-6)6 would indicate 2 hours of lecture-recitation and 3 hours of laboratory for the first semester followed by 1 hour of lecture-recitation and 6 hours of laboratory the second semester, for a total credit of 6.

5. The prerequisites for the various subjects are shown. No student can be officially registered in a subject until the indicated prerequisites have been satisfactorily completed.

6. Subjects numbered 100-199 are normally given at the freshman level.

   Subjects numbered 200-299 are normally given at the sophomore level.

   Subjects numbered 300-399 are normally given at the junior level.

   Subjects numbered 400-499 are normally given at the senior level.

   Subjects numbered 500 and above are restricted to graduate students.

   No subject below 300 may be counted toward the Master of Science degree.

SUBJECTS ARE LISTED ALPHABETICALLY BY SUBJECT CLASSIFICATIONS, IRRESPECTIVE OF THE DEPARTMENT INVOLVED.

AIR SCIENCE

AS. 101-102 AIR SCIENCE AND TACTICS I (2-1) (2-1)4
Required of all freshmen — CAPT. MESLE AND AF ROTC STAFF

Introduces the AF ROTC cadet to the history of aviation and its development into the jet air-age. Provides the student with a fundamental knowledge of global geography and acquaints him with the international tensions and security structures of various nations of the world. Leadership and Drill provides for the development in the student of the qualities of leadership and discipline essential to Air Force officers and acquaints him with the fundamentals of drill.

AS. 201-202 AIR SCIENCE AND TACTICS II (2-1) (2-1)4
Required of all sophomores — CAPT. MILD AND AF ROTC STAFF

This subject covers the following: study of weapons, targets, types of aircraft, the air ocean, bases, and the USAF combat and support organizations. The USAF Officer Career Program is explained and a leadership laboratory is conducted in Officer Training.

AS. 301-302 AIR SCIENCE AND TACTICS III (4-1) (4-1)8

CAPT. INGERSOLL AND AF ROTC STAFF

This subject covers aircraft engineering, navigation, weather, military law, correspondence, problem solving techniques, self-expression. Leadership laboratory.

AS. 401-402 AIR SCIENCE AND TACTICS IV (4-1) (4-1)8

CAPT. MESLE AND AF ROTC STAFF

This subject covers the following: the framework of international politics; world powers and strategic areas; the security problem in relation to international power clashes. Principles of warfare and a historical survey of air warfare are reviewed. Briefing for commissioned service and a leadership laboratory complete the course.

CHEMISTRY

CHEM. 101 GENERAL INORGANIC CHEMISTRY (4-3)5

Required of all freshmen PROF. CHACE AND STAFF

This subject is concerned with the basic principles of chemistry and a consideration of non-metallic elements and their compounds.

CHEM. 102 GENERAL INORGANIC CHEMISTRY (3-3)4

Prerequisite: CHEM. 101 PROF. CHACE AND STAFF

Required of all freshmen except those in Courses IV and IX

In this subject, attention is focused on metals and their compounds. In the laboratory, special emphasis is placed on textile applications.

CHEM. 104 GENERAL INORGANIC CHEMISTRY (3-0)3

Prerequisite: CHEM. 101 PROF. CHACE

Required of freshmen in Courses IV and IX

In this subject, attention is focused on the metals and their compounds and a continuation of the studies of the basic principles is made.

CHEM. 112 QUALITATIVE ANALYSIS (2-3)3

Prerequisite: CHEM. 101 PROF. DALEY

Required in Courses VIII and IX

This subject covers the systematic qualitative analysis of inorganic compounds through use of semi-micro technique.

CHEM. 122 QUALITATIVE ANALYSIS (1-6)3

Prerequisite: CHEM. 101 PROF. DALEY

Required in Course IV MESSRS. BROWN AND LAVRAKAS

This subject covers the systematic qualitative analysis of inorganic compounds through the use of semi-micro technique.

CHEM. 124 ELEMENTARY STOICHIOMETRY (2-0)2

Prerequisites: CHEM. 101, MATH. 103 PROF. DALEY

Required in Courses IV, VIII and IX MR. BROWN

The elementary calculations of inorganic chemistry and qualitative analysis.

Chem. 201-202 ORGANIC CHEMISTRY (3-3) (3-3)8

Prerequisite: Chem. 102 or 104 Profs. Scattergood

Required in Courses IV, V, VIII and IX and Masaschi

This subject is a study of the industrial methods of preparation, properties, and mechanisms of reaction of important classes of carbon compounds together with the fundamental theories of organic chemistry. The laboratory work consists of the preparation of a representative member of each important series of organic substances.

Chem. 204 CHEMICAL TECHNOLOGY OF FIBERS (2-0)2

Prerequisite: Chem. 201 Mr. Peirent

Required in Course IV

A study of the chemical properties of the textile fibers and the resulting reactions with chemicals and dyes which are of technical importance. Both natural and artificial fibers are considered.

Chem. 211-212 QUANTITATIVE ANALYSIS (1-6)(1-6)6

Prerequisites: Chem. 104 and Chem. 122 Profs. Fickett and James

Required in Course IV

This subject covers the fundamental principles of quantitative chemical analysis. The first semester (Chem. 211) is devoted to the principles of gravimetric analysis, including the separations involved in mineral samples as well as the analysis of soluble salts. The second semester (Chem. 212) is devoted to the volumetric techniques involved in neutralization methods; permanganate, dichromate, and cerate oxidimetry; and iodimetry.

Chem. 213 QUANTITATIVE ANALYSIS (2-6)4

Prerequisites: Chem. 112 and Chem. 124 Prof. James

Required in Courses VIII and IX

This subject is designed to present the principles and techniques of gravimetric and volumetric analysis for non-chemistry majors. The gravimetric portion stresses the fundamentals involved in the analysis of soluble salts; the volumetric methods include acidimetry-alkalimetry, oxidation-reduction, and iodimetry.

The lecture hours are devoted to a study of the underlying principles and mathematical calculations involved in the laboratory operations.

Chem. 221 INTRODUCTION TO TEXTILE CHEMISTRY (2-0)2

Prerequisite: Chem. 102 Prof. Howarth

Required in Courses I, II, III, V, VI-G and VII

Not open to students in Course IV

This subject is designed for the non-chemist and consists of a series of lectures covering the various processes preliminary to dyeing. The preliminary treatments given the natural and manufactured fibers are covered as well as the action and properties of the textile chemicals used in these processes.

Chem. 222 INTRODUCTION TO TEXTILE CHEMISTRY (1-3)2

Prerequisite: Chem. 221 Profs. Howarth and Everett

Required in Courses I, II, III, V, VI-G and VII

Not open to students in Course IV

This is a continuation of Chem. 221. The application of the various classes of dyes to the natural and manufactured fibers is covered. The methods of dye-

ing, the fastness properties of the different classes of dyes, and the nature and use of dyeing assistants is taken up. The principles covered in the lectures are illustrated by work in the laboratory.

CHEM. 241-242 STOICHIOMETRY (1-0) (1-0)2
Prerequisites: CHEM. 104 and CHEM. 124
PROFS. FICKETT AND JAMES
Required in Course IV

This subject parallels and augments CHEM. 211-212 with a detailed consideration of the mathematical calculations involved in quantitative chemical analysis.

CHEM. 311 TEXTILE QUANTITATIVE ANALYSIS (1-3)2
Prerequisites: CHEM. 212 and CHEM. 242
PROFS. FICKETT AND JAMES
Required in Course IV

This subject covers the examination of materials used in the textile mill, the dyehouse, and the finishing plant. Emphasis is placed on the practical techniques employed in the standard methods for analyzing and evaluating bleaching agents, industrial water, soaps, and oils.

CHEM. 312 TEXTILE QUANTITATIVE ANALYSIS (1-3)2
Prerequisite: CHEM. 311
PROFS. FICKETT AND JAMES

This subject is designed for the student who is interested in a continuation of the practical techniques studied in CHEM. 311. The course is extended to cover the examination of vegetable, animal, and lubricating oils; sulfated oils; and synthetic detergents.

CHEM. 321 TEXTILE CHEMISTRY (2-3)3
Prerequisites: CHEM. 202, ENG. 104, PHYS. 202
Required in Course IV
PROFS. HOWARTH, EVERETT AND SCATTERGOOD

This subject is designed primarily for those majoring in chemistry and is the first of four semesters of work relating to the chemistry of all types of textile fibers i.e. cotton, wool, rayon, nylon, and synthetics. Lectures are given by Prof. Howarth on operations preliminary to dyeing. Lectures are given by Prof. Scattergood on the physical organic chemistry of dyes. Operations preliminary to dyeing are carried out in the laboratory.

CHEM. 322 TEXTILE CHEMISTRY (2-3)3
Prerequisite: CHEM. 321
Required in Course IV
PROFS. HOWARTH AND EVERETT

This subject is a continuation of the work started in CHEM. 321. The following topics are discussed: Water in the Textile Industry, Theory of Dyeing, Coloring Matters, and Dyeing Processes.

CHEM. 331-332 PHYSICAL CHEMISTRY (3-1½) (3-3)7½
Prerequisites: CHEM. 124, CHEM. 242, MATH. 202 OR 204 *and* PHYS. 202
Required in Courses IV, VIII and IX
PROFS. CHACE AND LISIEN

A study of the important principles of physical chemistry, i.e., gaseous, liquid, solid states; elementary chemical thermodynamics; determination of molecular weights; viscosity; surface tension; etc.

Topics covered include dilute solutions, chemical equilibrium, phase equilibrium, free energy, and electrical properties of solutions.

CHEM. 333 INDUSTRIAL STOICHIOMETRY (3-0)3

Prerequisite: CHEM. 124 and CHEM. 213 — PROF. LEWIS

Required in Course VIII

This comprises the study of some important operations in the chemical industry, e.g., sulfuric acid, and in the pulp and paper industry from the standpoint of the application of reaction rate, mass and energy balance to prediction of performance, yield, etc. Recirculatory processes will also be studied.

CHEM. 335 CHEMISTRY OF THE PROTEINS (3-0)3

Prerequisites: CHEM. 202 *and* CHEM. 331 *taken concurrently* — PROF. CHOUINARD

Required in Course IX

A study of the chemistry of proteins with special emphasis on the collagen molecule.

CHEM. 342 ORGANIC QUALITATIVE ANALYSIS (1-3)2

Prerequisites: CHEM. 122 *and* 202 — PROF. SCATTERGOOD

The purpose of this subject is to acquaint the student with the latest methods available for the determination of unknown organic compounds. Special methods for dyestuff analysis are discussed.

CHEM. 352 CHEMICAL ENGINEERING (3-0)3

Prerequisites: CHEM. 104, CHEM. 331 MATH. 203 *and* PHY. 202 — PROF. MASASCHI

Required in Course VIII

Descriptive and quantitative information on unit conversion, dimensional analysis, materials of construction, flow of fluids, flow of heat, hygrometry, humidification, dehumidification, and drying, with special emphasis on textile application and textile chemical machinery.

CHEM. 362 GENERAL COLLOID CHEMISTRY (2-0)2

Prerequisite: CHEM. 331 — PROF. SKINKLE

Required in Courses IV, VIII and IX

This subject covers the basic general principles of colloidal chemistry, followed by elementary analyses of important problems encountered in amorphous materials such as paints, cellulosic products, leather, paper, and textiles.

CHEM. 411-412 ADVANCED TEXTILE CHEMISTRY AND DYEING (2-9) (2-9)10

Prerequisite: CHEM. 322 — PROFS. HOWARTH AND EVERETT

Required in Course IV

Continuation of CHEM. 321-322, covering (1) Color matching and color combining, (2) Dye testing and evaluation, (3) Union dyeing, (4) Printing, and (5) Dye house management.

CHEM. 414 SPECIAL STUDIES IN DYEING (1-3)2

Prerequisite: CHEM. 412 *or permission of instructor* — PROFS. HOWARTH AND EVERETT

A subject designed for those desiring more than the required work in dye application. Further work in dye application is given, also dye testing, color matching, and textile printing.

If the student has a particular problem in the application of dyes, time will be allotted for its study.

CHEM. 415 or 416 THEORY IN DYEING PRACTICE (2-0)2

Prerequisite: CHEM. 322 — MR. PEIRENT

This course consists of a study of fundamental chemical and physical aspects of the dyeing of protein, cellulose, and synthetic fibers. Consideration is given to the reaction of dyes with fibers, effects on dyeing of chemical and physical variations in fibers, and of chemical and physical processing of fibers, and the effects of variations in industrial dyeing techniques.

CHEM. 422 ADVANCED CHEMICAL TEXTILE TESTING (3-1)4

Prerequisites: CHEM. 212, and CHEM. 431 — PROF. MASASCHI

A series of lectures and laboratory periods designed to supplement the textile testing given in TEX. 311-312. The quantitative as well as the qualitative aspects of the determination of extraneous matter, textile finishing agents, fiber content, and fiber damage is followed by some dyestuff identification. The use of optical equipment such as the colorimeter, pH apparatus, spectrophotometer, ultra violet radiation and infrared radiation is also studied.

CHEM. 431 MACROMOLECULAR CHEMISTRY OF TEXTILE PROCESSES (2-0)2

Prerequisites: CHEM. 332 *and* CHEM. 362 — PROF. SKINKLE

Required in Course IV

The principles of general colloid chemistry are applied to specific textile applications. Wetting, detergency, the fibers themselves, dyes, and finishing processes are studied from the colloidal aspect.

CHEM. 441 ADVANCED CHEMICAL ENGINEERING (3-0)3

Prerequisite: CHEM. 352 — PROF. LEWIS

Required in Course VIII

An advanced study of the subjects covered in CHEM. 352, and, in addition, further work in thermodynamics, mechanical mixtures, heat engines, etc. This is an elective continuation of CHEM. 352.

CHEM. 451-452 ORGANIC CHEMISTRY OF NATURAL AND SYNTHETIC POLYMERS (3-0) (3-0)6

Prerequisites: CHEM. 202, CHEM. 321, CHEM. 332 — PROF. SCATTERGOOD

This subject presents the molecular structure of polymeric materials formed by addition, condensation, or natural polymerization.

The study of polysaccharides and proteins is introduced by a summary of the chemistry of the carbohydrates and amino acids. Special emphasis will be placed upon the study of polymeric materials used or potentially useful in the textile industry. Modified polysaccharides and proteins useful in the paper and leather industries will also be considered.

CHEM. 461 or 462 MICROBIOLOGY (1-3)2

Prerequisite: CHEM. 202 MR. BROWN

This subject considers the fundamentals of mycological and bacteriological theory briefly but in sufficient detail so that the problem of the microbiogical deterioration of textiles, paper, and leather may be discussed.

Methods of detecting mildewing, and methods of testing textiles for mildew resistance and bacteriological water analysis are also studied.

CHEM. 464 ADVANCED MICROBIOLOGY (1-3)2

Prerequisite: CHEM. 461 *or* 462 MR. BROWN

This work is arranged according to the interests of the individual student. Laboratory exercises such as the identification of pure cultures, the comparison of commercial mildewproofing agents, etc., are typical.

CHEM. 472 INORGANIC PREPARATIONS (2-3)3

Prerequisite: CHEM. 104 PROF. CHACE

The purpose of this subject is to familiarize the student with those reactions and processes of inorganic chemistry which are more used in commercial practice than in the laboratory. Experiments are chosen in conference between student and instructor.

CHEM. 473 THE THEORY OF ATOMIC AND MOLECULAR STRUCTURE (2-0)2

MR. LAVRAKAS

A discussion of the old theory of atomic structure precedes the topic of wave mechanics and its application to atomic and molecular structure. The following topics are presented: The Hydrogen Atom, the Periodic Classification of the Elements, the Covalent Bond, Saturation and Direction of Valency Bonds, Resonance, Method of Molecular Orbitals, and Complex Compounds. In addition, about a fourth of the course is spent on the Hydrogen Bond and the Theory of Acids and Bases.

CHEM. 474 THE THEORY OF ATOMIC AND MOLECULAR STRUCTURE OF TEXTILE DYES AND FIBERS (2-0)2

MR. LAVRAKAS

The subject is a continuation of CHEM. 473. Papers are presented by members of the class about the newer theories of atomic and molecular structure relating to dyes or fibers.

CHEM. 475 or 476 SPECIAL STUDIES IN PHYSICAL CHEMISTRY (1-3)

Prerequisite: CHEM. 331-332 PROF. CHACE

Open to seniors and graduate students who have shown interest and aptitude for physical chemistry.

An opportunity for those especially interested in the methods of physical chemistry to do further work in the laboratory. Preference will be given to those who wish to investigate the application of recent techniques which may be applied in industry.

Laboratory work and conferences as arranged with instructor.

CHEM. 481 or 482 TRACER TECHNIQUES (1-3)2

Prerequisite: Permission of Instructor PROF. CHACE

Consideration is given to the use of radioactive substances as tracers. In the laboratory the fundamental techniques of counting, feather analysis, "hot lab." syntheses, radioautographs, etc., are covered. The safe handling of radioactive materials at the microcurie level will be stressed.

CHEM. 501 or 502 APPLICATION OF COLOR MEASUREMENT

Credits and hours to be arranged PROF. SKINKLE

Prerequisite: CHEM. 422 *or equivalent*

This subject covers the description and use of transmission and reflection colorimeters and also the spectrophotometers and recording spectrophotometer. The calculations from the results are studied and the use of the instruments in dye application research is thoroughly investigated.

CHEM. 503 INTERPRETATION OF DATA (2-0)2

PROF. SKINKLE

Mathematical methods of analyzing, plotting and interpreting experimental data, which lead to properly weighted quantitative results are studied by means of lectures and exercises.

CHEM. 505 PHYSICAL CHEMISTRY OF DYEING (2-0)2

PROF. SKINKLE

This is a combination of lectures and seminar sessions on the physico-chemical principles involved in the application of dyestuffs to textile materials.

CHEM. 508 METHODS OF DYE RESEARCH (1-2)2

PROF. SKINKLE

A series of conferences and laboratory periods are devoted to a survey of procedures necessary in fundamental dyeing studies.

CHEM. 511 or 512 SURFACE ACTIVE AGENTS

Credits and hours to be arranged PROF. SKINKLE

Prerequisite: CHEM. 431

A laboratory study, with conferences, on the evaluation of standard wetting agents, detergents, and analogous auxiliaries, with particular emphasis on industrial application.

CHEM. 521 or 522 TEXTILE TESTING PROBLEMS

Credits and hours to be arranged PROFS. SKINKLE

Prerequisite: CHEM. 422 AND MASASCHI

Special problems relating to the design and evaluation of improved analytical or testing procedures.

CHEM. 525 or 526 EVALUATION OF FINISHING AGENTS

Credits and hours to be arranged PROF. MASASCHI

Prerequisite: TEX. 312

A laboratory study designed to teach the use of the various test methods and instruments in evaluating the effect of finishing treatments on the tactile and end-use properties of a fabric.

CHEM. 527 INSTRUMENTAL METHODS IN TEXTILE RESEARCH (1-2)2

PROF. MASASCHI

Lectures and laboratory instruction in the use of research apparatus in modern textile research techniques. Experiments are designed to include such instruments as the Fisher and the Beckman titrimeters; the Stormer, the Zahn and the Brookfield viscosimeters; the Abbé and the immersion refractometers; the Du Nöuy and the manometric tensiometers; and the Instron Tensile Tester.

CHEM. 531-532 TEXTILE CHEMISTRY SEMINAR (2-0) (2-0)4
PROF. SKINKLE

A series of informal discussions of current problems in research and technology in the textile chemistry field. Special investigations of the literature will be utilized to serve as a source of seminar topics.

COTTON

COTTON 201-202 COTTON CARDING (3-2) (3-2)8
Prerequisites: ENG. 102 *and* ENG. 112 PROF. POPE
Required in Courses I and VI-G

This is a study of the growth, classing, and handling of raw cotton and the processes of opening, picking, carding, combing, drawing and roving. Considerable time is devoted to the studying of cotton production and characteristics so that the student may have a real appreciation of some of the processing problems originating in the cotton itself. Experiments and studies of the card room machinery are designed to acquaint the student with typical mill equipment and its use in processing commonly used cottons. The mill processes are studied in detail, through specially prepared texts and illustrations. Emphasis is placed on the purposes and principles of each machine rather than on skill of operation.

COTTON 211 COTTONS (1-6)3
Prerequisites: COTTON 201 *taken concurrently,* ENG. 102 *and* ENG. 112 PROF. POPE
Required in Course I

This subject consists of lectures and laboratory work, supplementary to COTTON 201, for those students who major in cotton manufacturing. The economic importance of cotton is studied, and sources of information regarding cotton and its processing are given to the class. Some time is spent on the details of cotton fiber growth and structure. The commonly measured fiber characteristics are considered with a study of the tests and equipment more commonly used in measuring cotton fiber qualities.

Laboratory time is spent on cotton fiber study work and processing and machinery studies supplementary to, and more detailed than, the work of COTTON 201.

COTTON 222 COTTON WASTE PROCESSING (1-6)3
Prerequisites: COTTON 201 *and* COTTON 202 *taken concurrently.* PROF. POPE
Required in Course I

For those specializing in Cotton Manufacture, this subject provides a survey of the methods and machinery used in processing cotton wastes or new cotton handled on waste machinery. The lectures consider the sources of the various wastes, their preparatory treatment, and the manufacturing processes.

Laboratory work includes the study of ordinary processing wastes, their treatment in preparation for processing, and experiments on machinery used for yarn manufacture by the waste system.

Some of this laboratory time is used to give additional instruction on regular carding, combing, drawing, and roving equipment.

Cotton 231 COTTON YARN MANUFACTURE SURVEY (2-0)2
Open only to students in Course IV Mr. Kent

For students with but a secondary interest in Cotton Manufacture, this survey outlines the processes used and the principles of Cotton Yarn Manufacture. The work covers cotton qualities and the production processes of opening, picking, carding, combing, drawing, roving, and spinning.

Cotton 301-302 COTTON SPINNING (2-3) (2-3)6
Prerequisite: Cotton 202 Prof. Goodwin
Required in Course I

This subject is a continuation of the study of yarn manufacture and covers the many types of regular and long draft spinning, spooling, winding and twisting machines and their products—plain and fancy yarns, threads, cords and ropes. Particular consideration is given to the production of yarns for different uses and to methods by which desired characteristics may be obtained. All the calculations regarding yarns, spinning frames, spoolers, winders, and twisters are thoroughly studied and problems are assigned for student practice. The laboratory work consists of a series of experiments, synchronized with the lectures, to demonstrate and supplement classroom discussions. In the laboratory, standard industrial machinery is used to process fibers such as are commonly used in cotton mills.

Cotton 303-304 COTTON SPINNING (2-2) (2-2)6
Prerequisite: Cotton 202 Prof. Goodwin
Required in Course VI-G

This subject is similar to Cotton 301-302, but the time devoted to laboratory practice is shortened.

Cotton 311 STAPLE FIBER MANUFACTURE (1-2)1½
Prerequisite: Cotton 301 *taken concurrently* Mr. Kent
Required in Course I

With the preparatory subjects as a background, this subject offers a study of the methods of manufacture of various staple fibers, such as wool, rayon, or the new synthetics, on regular or modified cotton machinery. As this is a rapidly changing field, the subject is planned to take advantage of the new developments as they appear. A considerable amount of the work in this subject is of the discussion type, which aims to correlate all the work on yarn manufacture and to bring it to bear on the processing of staple fibers.

Cotton 322 COTTON QUALITY CONTROL (1-2)1½
Prerequisites: Cotton 301 *and* 302 *taken concurrently* Prof. Goodwin
Required in Course I

While it is customary to point out defects in the materials during the processing in all the lecture and laboratory work, this subject provides a logical summary of the usual defects which appear in different stages of cotton manufacture. The student is taught to recognize defective work and is given the usual causes of the common defects. The usual procedures and methods necessary to avoid or correct the defects are explained. Many samples of defects are used to illustrate this subject. Every effort is made to develop the diagnostic ability of the student so that he may readily recognize and remedy defects as he meets them.

Cotton 331 or 332 COTTON YARN MANUFACTURE SURVEY (3-1)3
Not open to students in Course I or VI-G Mr. Kent

For students with but a secondary interest in cotton manufacture, this survey outlines the processes used and the principles of cotton yarn manufacture. The work considers cotton qualities and production, the processes of opening, picking, carding, combing, drawing, roving, spinning, winding, and twisting.

While this subject consists primarily of lectures, it is planned to include some laboratory demonstrations. Outside preparation will include some study of the standard manufacturing machinery in the laboratory.

Cotton 401 MILL ORGANIZATION (4-0)4
Prerequisite: Cotton 302 *or* 304 Prof. Goodwin

This subject correlates all of the work on cotton manufacturing. Starting with a study of actual mill organizations the class is carried forward to problems in developing new organizations for specific types of products. The adaptations for long draft and for the handling of staple fibers are carefully covered. Calculations are made for the machinery necessary to keep plants in balance with some consideration of the best arrangements for economical handling.

Cotton 402 MANAGEMENT PROBLEMS (2-0)2
Prerequisite: Cotton 401 Prof. Goodwin

This subject supplements the one in Mill Organization with some added detail regarding the work in Mill Organization. It includes work on job descriptions, job assignments and work load studies. Some time is spent considering arrangement of machinery for practical routing and operation, auxiliary equipment necessary and materials handling problems for efficient manufacturing.

Cotton 411-412 MAJOR PROJECT Credit to be arranged
Prerequisites: Cotton 302 *and* 322 Staff

For students majoring in cotton manufacturing, this subject offers an opportunity to do additional work in some phase of cotton manufacturing for which the student is prepared. Topics to be selected must meet the approval of the head of the department. (This is a type of optional work intended to permit senior students to extend their acquaintance in fields where they have previously built some background. Permission to work in any area must depend upon availability of staff and equipment to meet properly the needs of the students.)

DESIGN

Des. 101 or 102 ELEMENTARY TEXTILE DESIGN (2-1)2
Prof. Golec

Instruction is given in the subject of classification of fabrics, use of point or design paper, plain fabrics, intersection, twills and their derivation, sateen, basket and rib weaves, checks, stripes, fancy weaves including figured and colored effects; producing chain and draw from the design, and vice versa; and of extending and extracting weaves.

Des. 103 or 104 YARN CALCULATION (1-0)1
Prof. Golec

This subject includes relations and determinations of yarn numbers of cotton, woolen, worsted, linen, silk, and synthetic; grading of folded, ply, novelty and fancy yarns.

Des. 122 PERSPECTIVE (0-2)1

Prof. Rosatto

This subject equips the student with a mechanical method of representation. Through the study of vanishing points and measuring points the student learns to represent on a two dimensional surface, objects of three dimensions showing correct proportions as they appear to the eye.

Des. 203-204 TEXTILE DESIGN AND FABRIC ANALYSIS (3-2) (3-2)8

Prerequisites: Des. 102 *and* 104 — Prof. Fox

Open only to students in Course III

In the first semester, consideration is given to cotton and synthetic fabrics, both filament and spun, weaving plain, twill, or sateen constructions, and employing stripe, check or plaid patterns. In the second semester, fabrics studied are those having extra warp and extra filling figured patterns, Bedford cords, velveteens, plushes and corduroy, as well as 2-ply, 3-ply, and 4-ply fabrics, together with their analysis in wide woven widths. In both semesters, the work includes the analysis of the fabrics as well as the necessary calculations required to reproduce them or to construct fabrics of similar character.

Des. 222-223 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4

Prerequisites: Des. 101 *and* 103 — Prof. Fox

Required in Courses I, V (222) and VII

Not open to students in Course III

This subject offers work similar but less detailed than the material covered in Design 203-204 and Design 301-302.

Des. 224 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2

Prerequisites: Des. 101 *and* 103 — Prof. Fox

Required in Courses VI-E and VI-G

Not open to students in Course III

This is a skeleton subject patterned after Des. 222-223.

Des. 232-233 FABRIC DESIGN AND ANALYSIS FOR MANUFACTURERS (2-1) (2-1)4

Prerequisites: Des. 101 *and* 103 — Mr. Gray

Required in Courses II and VII

Not open to students in Course III

This subject offers work similar to, but less detailed than, the material covered in Design 211-212 *and* Design 311-312.

Des. 234 FABRIC DESIGN AND ANALYSIS FOR ENGINEERS (2-1)2

Prerequisites: Des. 101 *and* 103 — Mr. Gray

Required in Courses VI-E and VI-G

Not open to students in Course III

This is a skeleton subject patterned after Des. 232-233.

DES. 251-252 COLOR (1-1) (1-1)4

Open to students in Courses III and VII PROF. ROSATTO

This is a study of color, value and chroma using the Munsell Color System. Several plates painted by the student show the application of color to textiles. These plates include perfected harmony and distribution in patterns illustrating stripes, checks, plaids, and decorative designs. The influence of colors upon each other is stressed to equip the student with a working knowledge which will aid him in his choice of color for the fabric in question.

Because of the work required as a part of the laboratory, extra credit is allowed.

DES. 261 COLOR (1-1)1

Required in Course I PROF. ROSATTO

This subject includes the same general information as DES. 251-252 but in less detail.

DES. 271 or 272 COLOR (1-1)1

PROF. ROSATTO

This subject includes the same general information as DES. 261 but deals with blends of colored stock.

DES. 301-302 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisite: DES. 204 PROF. FOX

Open only to students in Course III

In the first semester, consideration is given to cotton ply fabrics including the weave and construction of two-ply, three-ply, and four-ply fabrics together with the analysis of these fabrics in narrow woven non-elastic and elastic belts and webs. The second semester covers piques, lappet and swivel-woven fabrics, as well as Mitchelins, loose and fast-back quilting fabrics, toilet cloths, and leno fabric design using the modern steel doups and super-doups.

DES. 303 SYNTHETIC FABRIC DESIGN AND ANALYSIS (1-2)2

Prerequisite: DES. 222 *or* 224 PROF. FOX

Required in Course V

This subject covers the comparison and analysis of various synthetic fabrics as to the construction, yarn denier, filament size, and weave, as well as finished fabric characteristics.

DES. 313-314 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisites: DES. 102 *and* 104 MR. GRAY

Open only to students in Course III

In the first semester, instruction is given in the construction and analysis of standard woolen and worsted fabrics containing synthetic yarn or mixes. In the second semester, instruction is given in the construction of warp and filling backs, double and triple cloths. Chinchillas, and extra warp and filling figures.

DES. 403-404 TEXTILE DESIGN AND FABRIC ANALYSIS (2-2) (2-2)6

Prerequisite: DES. 314 MR. GRAY

Open only to students in Course III

This subject includes cost estimating for worsted and woolen fabrics, and the cost of various blends and mixes of stock and loom production. The work in

cloth construction includes the application of the different weaves and their combinations in the production of fancy designs as well as the calculation involved in the reproduction of various fabrics changed to meet varying conditions of weight, stock, size of yarn and value. Particular attention is given to the construction of new designs by the use of suggestion sheets as well as to the new fabrics to be constructed upon a base fabric, previously analyzed, in the manner outlined on the suggestion sheets, keeping within the given price range. This includes Designer's Blankets to be worked out as required by the suggestion sheets. This subject is restricted to woolen and worsted fabrics, but includes blends with other fibers, as well as filament yarn combinations for fancy effects.

DES. 406 ADVANCED TEXTILE DESIGN AND ANALYSIS (2-1)2

Prerequisites: DES. 302, DES. 403. WEAV. 302 *or permission of instructor* PROF. GOLEC

Open only to students in Course III

The first half of the semester is devoted to the study of Leavers Lace including history, manufacture, finishing, a detailed study of the Leavers machine, and the basic principles of lace design and drafting. The second half of the semester covers a study of embroideries and rugs. Schiffli embroidery includes the Schiffli machine, basic principles of Schiffli design, manufacturing, finishing and types and end uses of embroidery. Rugs include a study of the principles of construction of the analyses of Chenille, Wilton, Brussel, Tapestry, Velvet, and Axminster carpets.

DES. 411-412 JACQUARD DESIGN AND WEAVING (1-2) (1-2)4

Prerequisites: DES. 204, WEAV. 302 PROFS. GOLEC. HOELLRICH AND MERRILL

Required in Course III

This subject correlates the instruction in weaving on the Jacquard loom and the various tie-ups in common use. Instruction includes the sketching of original designs as applied to particular fabrics. The student is taught to transfer his original sketch to cross section design paper, to choose the proper weave for both the background and foreground, to cut cards and lace, and to weave the fabric.

DES. 413 or 414 JACQUARD DESIGN (0-2)1

Prerequisites: DES. 101 *or* 102 PROFS. GOLEC AND MERRILL

This is an elective subject in which the student is taught to transfer a given motif to cross section paper, to choose the proper weave for the background and the foreground, and complete a Jacquard design. A sufficient number of cards are cut and laced to enable the student to appreciate the complete operation from the motif to the loom.

DES. 421 or 422 DESIGN AND WEAVING SEMINAR STAFF

Credits and hours to be arranged

Prerequisite: Major in Course III or by special permission

This subject consists of field trips to selected mills, alternating with reports and seminar discussion of field work.

ECONOMICS

Eco. 201-202 ECONOMICS (3-0) (3-0)6
Required in Courses I, II, III, IV, V, VI-E, VI-G and VII PROF. CUSHING

This course is a basic one in the principles and practices of economics. It deals briefly with economic history, showing how the present economic system has evolved from past systems. It shows how the experience of the past can aid in the solution of present problems.

Eco. 311 ECONOMIC STATISTICS (3-0)3
Required in Course VII PROF. EDLUND

This subject covers the basic concepts of the statistical method with special emphasis on those approaches of most interest to the student of management. Topics covered include: measures of central tendency, graphic methods, dispersion, skewness, sampling, normal curve, index numbers, correlation, time series, secular trend, seasonal variation, business cycle, and statistical forecasting.

Eco. 321-322 PRINCIPLES OF MARKETING (3-0) (3-0)6
Required in Course VII PROFS. EDLUND AND MANDELL

ECO. 321 is an introduction to the basic principles underlying the modern systems of distributing goods with special emphasis on the raw and finished products of the textile industry. This subject will cover the history and economic importance and the functions in modern distribution of the selling agent, the commission man, the broker, jobber, merchant, factor, and other intermediaries. It will also consider the channels that goods may take from the producer to the ultimate consumer. The importance and advantages of each will be studied with special emphasis on the present practice and trends in the textile industry.

ECO. 322 is a continuation of ECO. 321. Some of the topics studied are economic aspects of fashion, branding, sales promotion and advertising, market research, analysis of distribution costs, forecasting, market potentials, price policies, legal aspects of marketing, vertical integration, sales planning and control and the complete campaign.

Eco. 341 ACCOUNTING—I (3-0)3
Required in Course VII PROF. MANDELL

This is a basic course in accounting. The first portion of the semester will be devoted to a consideration of the economic significance of accounting, the underlying accounting theories, and the organization and use of modern accounting records. Attention will be given to the preparation and interpretation of reports and statements of financial position. The balance sheet, profit and loss statement, theory of debits and credits as applied to journalizing, and the usage of the various ledgers will be covered. Cost accounting methods and systems as applied to industry will be the subject of discussion for the last portion of the semester's work.

Eco. 342 ACCOUNTING—II (3-0)3
Required in Course VII PROF. MANDELL

This course is designed to further acquaint the student with accounting practice, emphasis here being placed on partnership and corporate records. Special emphasis will be given to payroll and tax accounting in addition to work dealing with installment and branch accounting techniques. The peculiar aspects of manufacturing accounting will be covered in detail, with the application of cost principles to this area.

Eco. 344 PRINCIPLES OF SELLING AND ADVERTISING (3-0)3

Required in Course VII PROF. EDLUND

A comprehensive subject dealing with the fundamental principles of advertising and salesmanship. Topics covered include: psychology of selling and advertising, copy writing, layout, printing and engraving, testing and research, planning an advertising campaign, government restrictions, types of media, radio advertising, trademarks, building a selling talk, fundamentals of salesmanship, types of personal selling, personality, retail salesmanship, training, etc.

Eco. 351 TEXTILE MARKETING (2-0)2

Required in Courses I, II, III, IV, V PROF. EDLUND

This subject is a condensation of the more important parts of Eco. 321 and 322, of particular interest to those not specializing in distribution. It will survey the marketing channels for textiles, chief intermediaries, fashion, branding, marketing research, vertical integration, and sales promotion.

Eco. 412 INDUSTRIAL MANAGEMENT: PRINCIPLES AND PROBLEMS (3-0)3

Required in Courses I, II, III, V, VI-E, VI-G, VII and IX STAFF

This subject is divided into four general areas: backgrounds of modern industry; organization of the industrial enterprise; the operation of the modern industry; and coordination of the productive processes. The text material is supplemented with current readings and case material.

Among the topics covered are:. Risks, Forecasting, Financing, Product Development, Plant Layout, Production Controls, Personnel Management, Time and Motion Studies, Job Evaluation, and Wage and Salary Administration.

Eco. 421 FOREIGN TRADE (3-0)3

Prerequisite: Eco. 202 PROF. MANDELL

This subect will cover the growth and development of foreign trade, international commercial policies, transportation and communication facilities, and international finance. A good portion of the term's work will be devoted to a study of the practical aspects of exporting and importing. Examples will be given in the textile field wherever possible and actual documents relating to foreign trade will be exhibited and used in regular class work.

Eco. 431-432 SELLING POLICIES (3-0) (3-0)6

Prerequisite: Eco. 322 PROF. EDLUND

This subject will cover the development of administrative policy and guiding principles in the marketing, pricing, styling, and merchandising of textile products. Topics covered include: sales supervision and control, credit policies, inventory control, standardization and simplification, the sales contract, arbitration, trade associations, principles of wholesaling and retailing, and use of cost accounting in distribution.

The second term is conducted by the seminar method and includes discussions and reports on business cases involving all phases of management and distribution policy.

Eco. 468 FINANCIAL MANAGEMENT (2-0)2

PROF. MANDELL

This subject will cover the organization and financing of private enterprise, partnership, trust, and corporate types of business establishments. A portion of

the semester's work will be devoted to a study of the stock and bond markets. Emphasis will be placed on the study of the corporation in formation, operation, dissolution, and reorganization.

ENGINEERING

ENG. 102 MECHANISM (4-0)4

Required in Courses I, II, V, VI-E VI-G and VII PROF. THOMAS

This course is a study of the basic principles of kinematics, in which the wide variety of process machinery available furnishes many specific examples. Frequent use of these mechanisms is made in the development of the subject. Some of the important topics covered are the following: rolling cylinders and cones, gearing, gear train design, epicyclic gear trains, flexible connectors including stepped pulley and cone design, cam design, linkages, and miscellaneous mechanisms.

ENG. 104 MECHANISM (2-0)2

Required in Courses III, IV, VIII and IX PROF. THOMAS

Not open to students in Courses VI-E and VI-G

This subject is an abbreviation of ENG. 102, and is designed for those students not majoring in engineering.

ENG. 111 ENGINEERING DRAWING (0-6)2

Required in all courses PROFS. GELINAS AND AINSWORTH
MR. ROGERS

This subject consists of both freehand and mechanical drawing and covers the following items: lettering, geometric construction, orthographic projection, isometric and cabinet drawing, and dimensions.

ENG. 112 ENGINEERING DRAWING (0-6)2

Required in Courses I, VI-E VI-G VIII and IX PROF. GELINAS, MR. ROGERS

A continuation of ENG. 111 which includes the following topics: auxiliary views, cross sections, advanced dimensioning, sketching of machine parts, working drawings, tracing and blueprinting, intersections, and developments.

ENG. 114 ENGINEERING DRAWING (0-3)1

Required in Courses II, III, V and VII PROF. GELINAS

A continuation of ENG. 111 and abbreviation of ENG. 112.

ENG. 122 MACHINE TOOL LABORATORY (1-2)1

Required in courses I, II, V, VI-E, VI-G VII and VIII PROFS. BELL AINSWORTH AND STAFF

The objective of this subject is to give the student an insight into the processing of metals through lectures and practical laboratory applications covering the basic machine tools such as the lathe, shaper, drill-press, and milling machine, and also the uses of measuring instruments, threads, and gears. Lectures and demonstrations cover topics such as pattern work, foundry practice, die-casting, welding, and forging.

ENG. 201 MACHINE DRAWING (0-3)1

Prerequisite: ENG. 112 PROF. GELINAS

Required in Courses VI-E and IX

This subject is made up of several short problems involving centers of gravity, counterweights, cam layouts, piping, welding, sheetmetal drafting, and assembly drawings.

ENG. 212 HEAT AND POWER (2-2)3

Prerequisite: PHYS. 201 PROF. WELLS

Required in Course II

Not open to students in Course VI-E or VI-G

This subject is similar to ENG. 311 but is briefer and is designed for those not majoring in engineering.

ENG. 221 TEXTILE MECHANISM (1-2)1½

Prerequisites: ENG. 102 *and* ENG. 112 PROF. HINDLE

Required in Course VI-E

This subject deals with the graphical and mathematical analyses of advanced mechanism found in textile machinery. The forces in, and velocities of, the various members of the mechanism are determined from actual data taken from the machines by the student himself.

ENG. 222 APPLIED MECHANICS (3-0)3

Prerequisites: Math. 201 *and* PHYS. 101 STAFF

Required in Courses VI-E and IX

This subject covers the fundamentals of statistics and kinetics, including such topics as force systems, laws of equilibrium, centers of gravity, moments of inertia, analysis of stresses in framed structures, momentum, energy, work and power, and the dynamics of the translation and rotation of rigid bodies.

ENG. 233 MACHINE TOOL LABORATORY (0-3)1

Required in Course VI-E PROFS. BELL AND AINSWORTH

This subject is a continuation of ENG. 122, giving practical and more detailed instruction in such operations as lay-outs, filing, drilling, planing and shaping, and places special emphasis on precision work.

ENG. 301-302 ADVANCED APPLIED MECHANICS (3-0) (3-0)6

Prerequisites: ENG. 222 *and* MATH. 202 PROF. HINDLE

Required in Course VI-E

This subject covers the general topic of strength of materials and includes such topics as simple stresses, strain, bending moments, hearing force, slopes and deflections in beams, beam design, torsion, and design of shafts.

The work of the second term deals with continuous beams, compound beams and columns, eccentric loading, combined stresses, reversals of stress, impact stresses, vibrations, and stress analysis by strain gage methods.

ENG. 312 HEAT ENGINEERING (3-2)4

Prerequisites: MATH. 202 *and* PHYS. 201 PROF. WELLS

Required in Course VI-E

The purpose of this subject is to familiarize the student with the principles of elementary thermodynamics, the properties of steam, mechanical mixtures, and combustion of fuels.

ENG. 321 STRENGTH OF MATERIALS (3-0)3

Prerequisites: MATH. 201 *and* PHYS. 101 STAFF

Required in Courses VI-G and IX

A more elementary and condensed treatment of ENG. 301-302.

ENG. 331 MILL ENGINEERING (3-0)3

Prerequisite: ENG. 222 PROF. HINDLE

Required in Course VI-E

This subject consists of a study of the various types of building construction used in the textile industry. It includes the following topics: details of construction from a study of actual blueprints, calculation of allowable floor loads, stresses in beams and columns, machinery layout and the use of the transit in elementary surveying.

ENG. 332 ENGINEERING MATERIALS (2-0)2

Prerequisite: PHYS. 202 PROF. HINDLE

This subject covers the manufacture, properties, and uses of important ferrous and non-ferrous metals; hot and cold processing, alloying, heat treament; also the properties and use of non-metallic engineering materials such as timber, cement, concrete, rubber, plastic, and mechanical fabrics.

ENG. 342 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4

Prerequisite: PHYS. 321 PROF. HORTON BROWN

Required in Courses VI-E and VIII

At the beginning of this subject polyphase circuits are considered. The greater part of the subject, however, is devoted to direct-current generators and motors with a study of their construction and characteristics. The accompanying laboratory work illustrates the various methods of measuring polyphase power and of determining the characteristics of direct-current generators and motors. To be followed by ENG. 401.

ENG. 344 ELECTRICAL MACHINERY (3-2)4

Prerequisite: PHYS. 321 PROF. HORTON BROWN

Required in Courses VI-G and IX

This subject is a condensation of ENG. 342 *and* ENG. 401.

ENG. 351 EXPERIMENTAL APPLICATIONS OF STATISTICS (3-0)3

Prerequisite: MATH. 201 *or* 203 PROF. BALL

Required in Courses VI-E, VIII and IX

The subject deals with those fundamental statistical measures which are required for the analysis of experimental data, and with the practical applications of statistical analysis to quality control and to the planning of industrial experiments.

ENG. 401 PRINCIPLES OF ELECTRICAL ENGINEERING (3-2)4

Prerequisite: ENG. 342 PROF. HORTON BROWN

Required in Courses VI-E and VIII

This is the second semester of work in the electrical field having been preceded by ENG. 342 in the junior year.

This subject includes detailed study of the three-phase circuit and the alternator, with particular stress on generation of three-phase currents. Methods of predetermination of alternator regulation are taken up and at least one method is compared with a laboratory test. Parallel operation of alternators with accompanying instruments and devices are studied in classroom and laboratory. The single-phase and three-phase transformers are considered in turn, and their various methods of connecting to line and alternators are systematically discussed. The induction motor and generator are studied with reference to their particular adaptability to the textile industry and the principal starting devices for the motor are covered in detail. The synchronous motor is studied particularly in relation to its ability to correct power factor.

ENG. 402 TEXTILE APPLICATIONS OF ELECTRICITY (1-4)1

Prerequisite: ENG. 344 *or* 401 PROF. HORTON BROWN

Required in Courses VI-E and VI-G

This subject covers the applications of electricity used by the textile industry including study of the commercial color analyzers, illumination of textile plants, static and lint eliminators, electronic rectifiers for motor control, range drives, electronic heating and drying, stop motions, scanning devices, and electronic relays. Trips are made to local mills to see the equipment in actual operation.

ENG. 403 PRINCIPLES OF HEAT ENGINEERING (3-2)4

Prerequisites: ENG. 102, MATH. 202 *and* PHYS. 201 PROF. WELLS

Required in Course VI-G

The basic principles of thermodynamics, properties of steam and its utilization in manufacturing processes, and the combustion of fuels are considered in this subject.

A brief treatment of steam engines, turbines and pumps is also included. Special consideration is given to the use of steam in textile mills.

ENG. 411 ADVANCED HEAT ENGINEERING (2-2)3

Prerequisite: ENG. 312 PROF. WELLS

Required in Course VI-E

The topics developed in the lectures and amplified in the laboratory are the Kinematics of stationary steam generating units, reciprocating engines, steam turbines, pumps, condensers, and internal combustion engines.

ENG. 422 TEXTILE PROCESS INSTRUMENTATION (2-0)2

Prerequisite: PHYS. 202 PROF. THOMAS

Required in Courses VI-E and VI-G

This subject is divided into three parts. First, a study is made of the indicating and recording instruments used to measure such common textile process variables as pressure, temperature, humidity, liquid level, fluid flow, etc.

The second part covers an analysis of the mechanisms (pneumatic and electric) which are used to control these variables and includes a detailed discussion of the final control elements, such as valves and motor levers, which are associated with the controller mechanisms.

Finally, typical applications of controllers to textile processes such as scouring, drying, sizing, bleaching, and finishing are studied from data obtained from actual mill installations.

Eng. 424 MACHINE DESIGN (2-2)3
Prerequisites: Eng. 221, 233 *and* 302 — Prof. Hindle
Required in Course IX

This subject covers the design of machine elements, such as fasteners, shafts, frames, bearings, gears, clutches, springs, keys and drives. Data for most of the problems are taken from actual machines in the various laboratories.

Eng. 425-426 ENGINEERING DESIGN OF TEXTILE STRUCTURES (2-0) (2-0)4
Prerequisites: Eng. 321, Math. 202 *and* Phys. 202 — Prof. Ball
Required in Course VI-E

This subject correlates engineering properties of textile materials, engineering principles, and textile processing in the design of textile structure with desired properties. The subject matter is presented in two major divisions. The first deals with the geometry of yarns and fabrics, and the extent to which it is possible to design the dimensions of a textile structure for a certain functional use or to predict the dimensional changes which will occur during such use. The second division deals with the design from the standpoint of the stresses, strains, and energy changes which the end-use imposes, and is based upon the information supplied by analyses of load-elongation diagrams of the textile structural material.

Eng. 431 ADVANCED PHYSICAL TESTING (1-3)2
Prerequisite: Tex. 312 — Prof. Thomas

This course is arranged to provide a more extensive background in the measurement and evaluation of the physical properties of textile materials. Some of the topics studied are: compression testing, engineering properties of fibers and yarns, stress-strain-time phenomena of visco-elastic materials, theory and operation of strain gage testing machines, methods of measurement of yarn evenness, thermal transmission, flexibility of fabrics, fabric friction, bursting stress, and crimp. The use of the microscope, as a tool of textile testing, is emphasized by the inclusion of appropriate experiments.

Wherever possible the laboratory experiments are arranged to develop confidence in the use of the customary methods of statistical analysis of data and to acquire familiarity with new ones.

Eng. 502 STATISTICAL QUALITY CONTROL (3-0)3
Prerequisite: Eng. 351 — Staff

This subject includes a study of the various types of control charts for maintaining quality of manufactured products and of the several types of sampling plans for the reduced inspection of manufactured products and of raw materials. Applications of the foregoing statistical techniques to industry in general are discussed, with special emphasis on their application to the textile and other industries.

Eng. 505-506 METHODS OF EXPERIMENTAL STRESS ANALYSIS (3-1)3½
Prerequisites: Math. 202, Phys. 202, Eng. 302 — Prof. Katz

An introduction to some of the experimental techniques used in stress analysis. Photoelasticity, electrical strain gages, brittle coating, and mechanical gages are considered in relation to the analysis of both static and dynamic stresses. Special attention is given to the application of these techniques in the study of textile structures and machinery.

ENGLISH AND HUMANITIES

ENGL. 101-102 ENGLISH COMPOSITION AND LITERATURE (3-0) (3-0)6
Required of all freshmen PROFS. DOW AND STEARNS

This course is a basic one in rhetoric and composition, relating specifically to the four forms of discourse—description, narration, exposition, argumentation. In addition, a selected group of classics is studied and discussed.

ENGL. 201 or 202 SPEECH (2-0)2
Prerequisite: ENGL. 102 PROF. DOW
Required in all courses

The aim of this subject is to achieve effective delivery of various types of speech. All kinds of delivery—extemporaneous, impromptu, memorized — and the like are studied and analyzed.

ENGL. 211 or 212 BUSINESS ENGLISH (1-0)1
Prerequisite: ENGL. 102 PROF. DOW
Required in all courses

Analysis and practice in letter writing, a study of the basic forms of technical exposition, forming a background for report writing in advanced courses and in industrial activity are the objectives of this course.

ENGL. 222 APPRECIATION OF LITERATURE (3-0)3
Prerequisite: ENGL. 102 PROF. DOW

This subject is offered for those who wish to study the principles of literary appreciation and criticism.

The prose and the poetry studied will be treated analytically, with directed investigation of the various literary appeals—the intellectual, the sensory, the emotional, the aesthetic, the imaginative, and the philosophical.

Emphasis will also be placed upon the value of an extensive reading program.

FINISHING

FIN. 401-402 WOOLEN AND WORSTED FINISHING (2-3) (2-3)6
Prerequisite: CHEM. 102 PROF. NOWELL
Required in Course II

This subject is designed to give the student a comprehensive introduction and orientation to the physical rather than chemical aspects of finishing, and includes burling and mending, fulling, washing and speck dyeing, carbonizing, gigging, napping, steaming, singeing, crabbing, brushing, shearing, and pressing.

FIN. 411 or 412 WOOLEN AND WORSTED FINISHING (3-3)4
Prerequisite: CHEM 102 *or* 104 PROF. NOWELL
Not open to students in Course II

This subject is a similar but abbreviated version of FIN. 401-402, designed for students not majoring in wool manufacture.

FIN. 421 COTTON AND SYNTHETIC FINISHING (3-3)4

Prerequisites: CHEM. 222 *and* TEX. 302 PROF. MCDONALD
MR. PEIRENT

Required in Courses I, III, V, VI-E, VI-G, and VII

All the major physical and chemical operations necessary for the conversion into the finished state of staple gray cotton and synthetic fabrics are considered. In addition to inspection, singeing, desizing, padding, drying, calendering, curing, etc., the preliminary wet processing operations through dyeing are illustrated. Among the types of finishes employed are those of starching, softening, repelling, stabilizing, decating, etc., as well as the thermo-plastic and thermo-setting resins; the physical, rather than the chemical, aspects are stressed.

FIN. 422 COTTON AND SYNTHETIC FINISHING (0-3)1

Prerequisite: FIN. 421 PROF. MCDONALD

Required in Course I MR. PEIRENT

This subject is a continuation of FIN. 421 *with* emphasis on conversions of blends, knit goods and printed fabrics.

FIN. 432 COTTON AND SYNTHETIC FINISHING (3-3)4

Prerequisites: CHEM. 202, TEX. 302 PROF. MCDONALD

Required in Course IV MR. PEIRENT

This is the same as FIN. 421 with chemical rather than physical, aspects predominant.

KNITTING

KNIT. 401 KNITTING (2-5)4

Prerequisites: DES. 223 *or* 233 *or* 234; ENG. 102 *and* ENG. 112 PROF. JONES

This subject is a broad survey of the important types of knitting. Considerable stress is placed on the various stitches and the characteristics of fabrics from each. Starting with flat machines, the work advances through small ribbers, automatic hosiery machines, full fashioned hosiery machines, underwear machines and warp knitters. The production, design, and analysis of knit fabrics and the classifications and routines for manufacture of hosiery and underwear are included.

KNIT. 403 or 404 KNITTING (2-3)3

Prerequisites: DES. 103; ENG. 102 *and* ENG. 112 PROF. JONES

This subject is similar to KNIT. 401, but requires less laboratory time.

KNIT. 412 ADVANCED KNITTING (2-5)4

Prerequisite: KNIT. 401 PROF. JONES

This is an advanced subject for students who are specializing in knitting. With the approval of the department head, the student may select a particular field from the various sections of the knitting industry and concentrate on its problems.

LANGUAGES

German. 201-202 TECHNICAL GERMAN (3-0) (3-0)6
Required in Course IX Prof. Cushing

This course is an introductory one in the basic elements of German, leading to a working knowledge of technical German. This subject is aimed primarily at developing a reading ability in scientific German.

German. 301-302 ADVANCED TECHNICAL GERMAN (3-0) (3-0)6
Prerequisite: German 202 *or equivalent* Prof Cushing
German 301 *may be taken without continuing* German 302

This course is designed to expand the student's elementary understanding of the language, to increase vocabulary, and to develop reading aptitudes in special fields of interest selected by the student.

LEATHER

Lea. 202 APPLIED LEATHER ANALYSIS (1-6)3
Prerequisite: Chem. 213 Prof. Chouinard
Required in Course IX

A subject designed to acquaint the student with the accepted methods of analysis of the American Leather Chemists Association and other supplementary procedures.

Lea. 301-302 LEATHER MANUFACTURE (3-6) (3-6)10
Required in Course IX Prof. Chouinard

This is the student's introduction to the general technology of leather manufacture. The first semester is devoted to examining government regulations in imported hides and skins, studying the purchasing of hides and skins, and classifying various hide damages. This is followed by work on the handling of raw stock at the tannery, unhairing, bating, and hide classification. The second semester is concerned primarily with the study of vegetable tanning, chrome tanning, and various other types of tanning. In the work throughout the year the material covered in lectures is supplemented by laboratory studies on a small scale.

Lea. 303 HISTOLOGY OF ANIMAL SKIN TISSUE (1-6)3
Prerequisite: Chem. 201-202 Staff
Required in Course IX

The histological study of animal hide as regards cell reproduction, glands and thermostat mechanism growth of hide fibers, elastin, nerve and grain patterns.

Lea. 304 MICROSCOPY IN TANNING (1-3)2
Prerequisite: Lea. 303 Staff
Required in Course IX

This subject is designed to educate the student in the use of a microscope as an aid in the study of hides and leathers under various conditions. The technique of using normal, fluorescent and polarized light is taught as well as the application of staining with some emphasis on photomicrograph.

LEA. 322 TANNING MECHANISMS (3-0)3

Prerequisite: CHEM. 201-202 — PROF. CHOUINARD

Required in Course IX

The general study of the various concepts applied to the understanding of what constitutes tanning, both practical and theoretical. This will involve a study of the raw materials as well as the finished product.

LEA. 401-402 LEATHER MANUFACTURE (3-6) (3-6)10

Prerequisite: LEA. 302 — PROF. CHOUINARD

Required in Course IX

A continuation of the study into the technology of leather manufacture covering the various currying treatments applied to rough leather such as fat liquoring, stuffing, dyeing and the various mechanical operations of setting, stretching, etc. It is intended to show how widely the physical properties of leather may be varied and controlled by the proper application and selection of these numerous operations and treatments.

LEA. 404 PROPERTIES OF LEATHER (2-3)3

Prerequisites: ENG. 351 *and* LEA. 401 — STAFF

Required in Course IX

A practical and theoretical study of the charactesistics of leather in relation to the end use. Studies will be made on measuring and classifying the effect of changes in manufacturing procedure, both chemical and physical. Leather, because it is a natural product, varies considerably within the same hide. Thus, the nature of this variation is very important and the study of any changes affecting it are, in turn, important.

LEA. 411-412 LEATHER PROBLEMS (1-6) (1-6)6

Prerequisite: LEA. 302 — PROF. CHOUINARD

Required in Course IX

This subject is designed primarily to enable the student to put into practical application the various scientific principles of physics, chemistry, mathematics, economics, etc. on problems of an industrial nature. This may encompass anything from the design and layout of any of a number of special leather plants to the suggested solution of practical problems which arise in the operation of a modern leather business.

MATHEMATICS

MATH. 103-104 COLLEGE MATHEMATICS (3-0) (3-0)6

Required of all freshmen — PROF. HARRY BROWN AND STAFF

The work in the first term consists of algebra and plane trigonometry. Algebra is reviewed through quadratics; and then logarithms, simultaneous equations, and theory of equations are studied. In plane trigonometry, the solution of right and oblique triangles is reviewed and identities and equations are taken up. Instruction in the use of the slide rule is given and the use of approximate data is discussed.

In the second term, the following topics are considered: the straight line, equations of various curves, differentiation of algebraic functions.

MATH. 201-202 ANALYTIC GEOMETRY AND CALCULUS (4-0) (4-0)8

Prerequisite: MATH. 104 PROF. HARRY BROWN
Required in Courses VI-E, VI-G and IX AND STAFF

In the first term the following topics are treated: Maximum and minimum values, rates and differentials, the circle, parabola, ellipse, hyperbola, indefinite integrals, summation by integration, and applications of integration. In the second term the topics treated are differentiation of transcendental functions, methods of integration, solid analytic geometry, polar coordinates, partial differentiation, and empirical formulas.

MATH. 203-204 MATHEMATICS FOR CHEMISTS (4-0) (4-0)8

Prerequisite: MATH. 104 PROF. OUELLETTE
Required in Courses IV and VIII PROF. HUMISTON
MR. DEVEJIAN

This subject is a continuation of MATH. 103-104. The first term consists of analytic geometry and calculus including the following topics: maximum and minimum values, rates and differentials, the conic sections, indefinite integrals, summation by integration, areas, volumes, pressures.

The second term includes exponential, logarithmic, and trigonometric functions; measurements and computation rules; properties of logarithmic equations; triangular graphs; semi-logarithmic and logarithmic graphs; exponential growth and decay; curve fitting; chemical applications of differential equations; and partial derivatives.

MATH. 211-212 MATHEMATICS (3-0) (3-0)6

PROF. HUMISTON
Prerequisite: MATH. 104 MR. DEVEJIAN
Required in Courses I, II, III, V and VII

The first term of this subject taken by students not majoring in chemistry or engineering, deals with applications of differentiation, analytic geometry of the conic sections, and integration of algebraic functions.

In the second term, applications of integration, construction of nomographic charts, and the derivation of empirical equations are considered.

MATH. 402 DIFFERENTIAL EQUATIONS (3-0)3

Prerequisite: MATH. 202 *or* 204 PROF. OUELLETTE

The following topics are treated: a review of series and partial differentiation, first- and second-order differential equations, and first- and second-order partial differential equations. The practical applications illustrated are designed for the chemist and the engineer.

PAPER

PAPER 201-202 PULP AND PAPER MANUFACTURE (3-0) (3-0)6

Prerequisite: CHEM. 102 PROF. LEWIS
Required in Course VIII

Lectures on the production and technology of pulp and paper.

PAPER 302 PULP AND PAPER MANUFACTURE (3-0)3

Prerequisite: PAPER 202 PROF. LEWIS
Required in Course VIII

This is a continuation of the earlier subject.

PAPER 303 PULP MANUFACTURE, TESTING AND ANALYSIS (2-6)4
Prerequisite: CHEM. 213 — MR. HOBBS
Required in Course VII

This comprises an elementary study of the principal woods and pulping methods used in pulp manufacture. The lecture work is accompanied by laboratory training in wood and pulp microscopy, pulping techniques, and pulp testing and analysis.

PAPER 312 PULP MANUFACTURE, TESTING AND ANALYSIS (4-6)6
Prerequisite: CHEM. 213 — MR. HOBBS
Required in Course VIII

This comprises an elementary study of the fundamental processing techniques used in paper manufacture. The lecture work is accompanied by laboratory training in paper making, paper testing and analysis, and paper microscopy.

PAPER 401 PRACTICE WORK IN INDUSTRY 18 CREDITS
Prerequisite: PAPER 302 — MR. HOBBS
Required in Course VIII

In order to give the student as thorough a knowledge of industrial problems and practices as possible, it is planned, in cooperation with several mills and converting plants, to set up practice stations. The students will spend several weeks at each of these stations working on technical problems of interest to the mill management, but under the supervision of a member of the Institute staff.

PAPER 403 MATERIALS OF CONSTRUCTION, CORROSION 2 CREDITS
Prerequisite: PAPER 401 *taken concurrently* — MR. HOBBS
Required in Course VIII

This subject, given at the Practice Stations, covers the common construction materials used in the industry and their ability to stand up under various conditions of use. It will be illustrated by examples in the plants studied.

PAPER 404 PAPER COATING AND CONVERTING (3-0)3
Prerequisite: PAPER 302 — PROF. LEWIS
Required in Course VIII

This subject covers the principal operation of the converting industry. Coating, treating and impregnating, laminating, embossing, and creping will be treated and, if time permits, printing.

PAPER 412 INDUSTRIAL CELLULOSE CHEMISTRY (1-0)1
Prerequisite: CHEM. 202 — PROF. LEWIS
Required in Course VIII

The manufacture and use of the chief cellulose derivatives will be reviewed. In addition, various chemical treatments for cellulose in the paper and textile fields will be discussed.

PAPER 414 ADVANCED PAPER PROBLEMS (2-6)4
Prerequisites: PAPER 303 AND PAPER 312 — STAFF
Required in Course VIII

This is designed to give the senior an opportunity to work upon a problem connected with some phase of the paper or paper converting industry. Problems will be selected by the student and staff in collaboration.

PHYSICAL EDUCATION (2-0)0

Prof. Cushing
Messrs. Morey and Yarnall

All members of the Freshman Class are required to take a course in physical training conducted under the direction of an instructor in physical education. It is planned to help each student meet reasonable standards of physical fitness, and through regularity and continuity of physical exercise, to maintain good physical condition. The men are taught basic skills in several team sports. Students on athletic squads are not required to attend these classes during the season they are actively engaged in that sport.

PHYSICS

Phys. 101 PHYSICS (4-1)4½
Required of all freshmen Prof. Thomas and Staff

This subject covers the basic principles of mechanics which are absolutely essential to more advanced studies in any scientific field. Some of the important topics covered are vector analysis, equilibrium of concurrent forces, equilibrium of non-current forces, rectilinear and curvilinear motion, inertia, harmonic motion, moment of inertia, conservation of energy, simple machines, hydrostatics and elements of hydraulics.

Phys. 201-202 PHYSICS (3-2) (3-2)8
Prerequisite: Phys. 101 Prof. Harry Brown
Required in all courses Mr. Hall

This is a continuation of Phys. 101 and is a basic subject relating to the laws and principles of physics and their application. The topics taken up the first term are wave motion and sound, thermometry, measurement of heat, change of state, expansion, transfer of heat, humidity, elements of meteorology, nature and propagation of light, and photometry.

The second term is devoted to the study of light, magnetism, and electricity. Some of the topics are reflection and refraction, lenses, the telescope and microscope, the spectroscope, color sensation, double refraction, magnetism, electrostatistics, fundamental laws of direct current and electrolysis, electronics, and elements of nuclear physics.

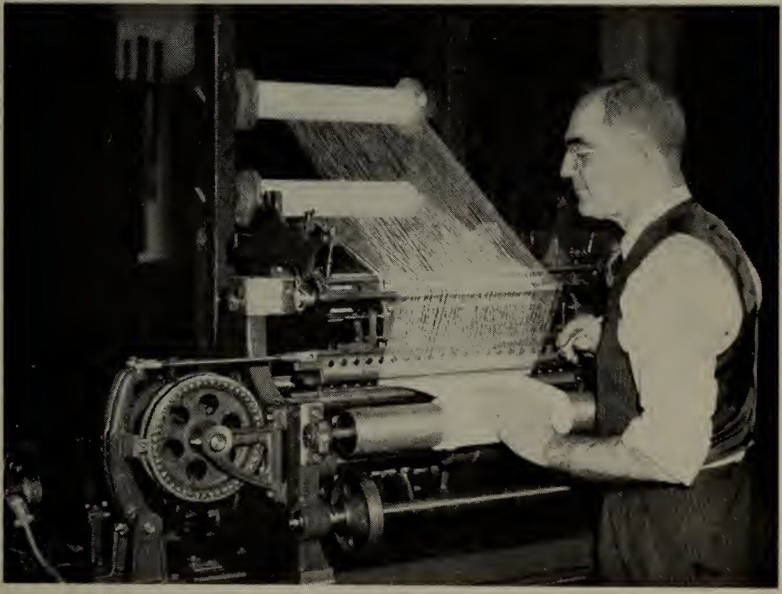
Phys. 321 ELECTRONICS VI-E (3-2)4
Prerequisite: Phys. 202 Others (3-1)3½
Required in Courses VI-E, VI-G VIII and IX Prof. Horton Brown

This subject covers the principles of alternating currents to the extent required for the understanding of electronic circuits. The elements of vacuum and gaseous-tube characteristics and of circuits containing such tubes for the purpose of rectification, amplification, and oscillation are discussed as well as industrial photoelectric relays, time delay relays, and Thymotrol motor controls.

Phys. 401 TEXTILE MICROSCOPY (1-3)2
Prerequisites: Phys. 202 *and* Tex. 312 Prof. Harry Brown

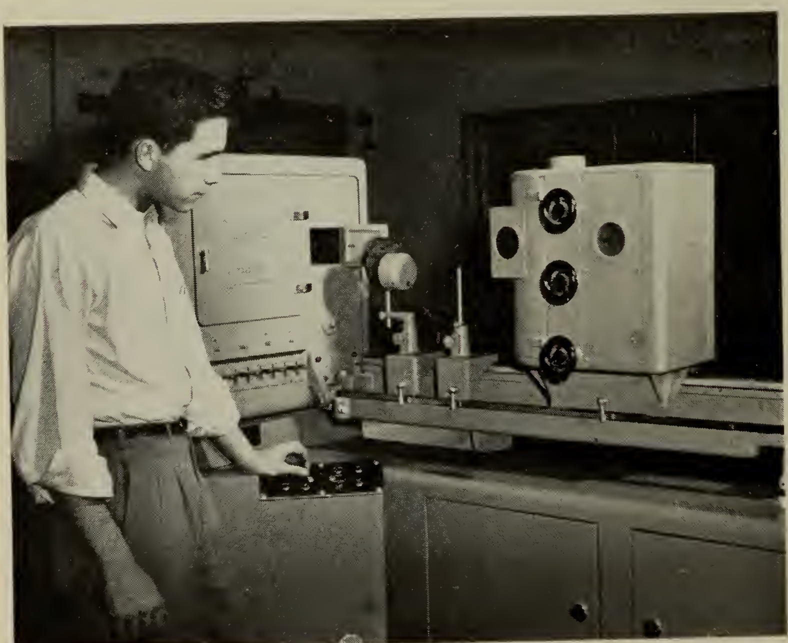
Applications of the microscope to textile materials are emphasized in this subject. It includes methods of sectioning, measurement of cotton immaturity and mercerization, determination of denier of rayon, wool grading, fiber identification, quantitative analysis of fiber mixtures and their practical applications. Some of

Woolen and Worsted Laboratory



Tricot Knitting Machine

Research with Radio Active Material



Research Using Spectograph

the more advanced aspects of critical microscopy which are essential for the best visual work and photographic practice are considered. Some time is devoted to photographic work and the use of polarized light.

PHYS. 402 TEXTILE PHYSICS (2-3)3

Prerequisites: MATH. 201, PHYS. 202, TEX. 312 PROF. HARRY BROWN

Textile Physics is designed primarily for graduate students but may be taken by seniors who have sufficient knowledge of elementary college physics, microscopy and testing. It deals in an analytical and experimental manner with the principles of advanced physics which have important applications to textile technology. The topics taken up include heat transmission of textile materials; color measurements; calculation of tristimulus values; transformation to dominant wave-length, colorimetric purity and brightness; measurement of refractive index of fibers; applications of phase microscopy; fluorescent microscopy; use of X-ray diffraction methods to determine crystal orientation and structure of fibers; spectrographic analysis; investigation of mineral elements in textile fibers; accurate methods of measuring stress, strain, viscosity, etc.

PHYS. 501 or 502 THE PHYSICS OF COLOR MEASUREMENT

PROF. HARRY BROWN

Prerequisites: MATH. 202 or 204 *and* PHYS. 202
Credit and hours to be arranged

Color measurement is an elective subject for graduate students who desire a comprehensive knowledge of the philosophy and practice of modern colorimetry. The topics covered include colorimeters, their uses and limitations, spectrophotometers, tristimulus values, dominant wave-length and purity, the "standard observer" concept, the Munsell system, the Ostwald system, color tolerances, gloss and body color, illuminants, and industrial applications.

Laboratory instruments available consist of brightness testers, monochromatic and trichromatic colorimeters, recording and visual spectraphotometers.

PHYS. 503-504 SPECTROGRAPHIC METHODS (1-3)2

Prerequisite: PHYS. 202 PROF. KATZ

Applications of the spectrograph for the qualitative and quantitative analysis of materials. Special attention is placed on the analysis of trace elements in textile materials and chemicals. Problems are assigned to the students and work is carried out under the supervision of the instructor.

PHYS. 505 or 506 X-RAY DIFFRACTION (1-3)2

Prerequisite: PHYS. 202 PROF. H. C. BROWN

The theory of X-ray diffraction and its application to the structure of matter is studied in this subject. Special consideration is given to the taking and interpretation of diffraction data obtained from fibers used in paper and textile technology.

PHYS. 507 or 508 ELECTRON MICROSCOPY (1-3)2

Prerequisite: TEX. 312 MR. SABBAGH

This subject deals with basic methods in the practice of electron microscopy including specimen preparation, use and operation of the electron microscope, vacuum techniques, and photography. This work is supplemented with special studies on selected topics.

SOCIAL SCIENCES

S.Sci. 101-102 WORLD ECONOMIC GEOGRAPHY (2-0) (2-0)4
Mr. Morey

Through a study of this subject the student gains an appreciation of the economic status of the different geographic areas of the world. It has been shown that the climate, the geographic structure, and the distribution of important raw materials have an effect upon the activities of the people inhabiting those areas and thus, on the types of industry which support the economic life of the various regions. Since the economic status of a geographic area contributes to the political stability of its people, a study of this subject should help the student to understand the present conflict in ideologies.

S.Sci. 212 WORLD HISTORY SINCE 1900 (3-0)3
Prof. Cushing

A study of the backgrounds in political, economic, and social conditions in the years preceding the outbreak of World War I, an examination of the world situation during the war years, 1914 to 1918; and a thorough review of the issues at Versailles and the spirit and content of the several treaties and settlements effected at the peace table. The body of the course content will concern the two-decade intermission, 1919-1939, with attention to such factors as the rise of new states; the origin and development of new concepts of nationalism, racism, and other phenomena; and the final alignment of world powers for World War II. The emphasis in the latter part of the subject will be upon the role of the United States in mid-twentieth century reconstruction and rehabilitation through world-wide international cooperation in agencies like the United Nations Organization, the International Bank, and others in which the United States must play a leading part.

Soc. Sci. 222 MAN AND HIS ENVIRONMENT (3-0)3
Required in Course VII Prof. Stearns

This subject considers the biological aspects of fundamental problems of heredity and environment which confront man in his economic, social, and cultural life. Emphasis is given particularly to the fields of ecology, genetics and eugenics, evolution, and anthropology.

Soc. Sci. 223 or 224 THE UNITED STATES SINCE 1865 (3-0)3
When requested by a sufficient number of students Prof. MacLaughlan

This course will provide a survey of the advancement of the American people from the Reconstruction Era through World War II. The agrarian problem, rise of big business, expansion of America into a world power, World War I, and the depression are some of the topics that will be discussed from the political, social, and economic viewpoint.

Soc. Sci. 301 MODERN ECONOMIC PROBLEMS (3-0)3
Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and IX Prof. Robertson

An intensive study of current developments in the American economy, with emphasis in such fields as security, welfare, labor unionism, labor economics, ownership and management of industry, and trends in government regulation. Lectures, selected readings, and case material will be utilized.

Soc. Sci. 302 MODERN LABOR PROBLEMS (3-0)3

Required in Courses I, II, III, IV, V, VI-E, VI-G, VII and VIII — Prof. Robertson

The subject will involve the use of a manual of current labor laws which apply in Labor-Management relationships in the United States. Case material will be studied to familiarize the students with Federal and State court actions, rulings of the National Labor Relations Board, and the functions of both public and private conciliators and arbitrators. At intervals during the term, the class will meet informally with representatives of both Labor and Management, and opportunities will be provided for discussion of important points with the visiting speakers. The chief objectives of this study will be (1) a proper consideration of the important current issues in collective bargaining and (2) the development of familiarity with the techniques of the bargaining table and the problems in drafting, interpreting, and administering the modern labor contract.

Soc. Sci. 311 PSYCHOLOGY (3-0)3

Required in Course VII — Prof. Edlund

The subject introduces the student to the place of psychology in the life of the individual and society and seeks to increase the student's understanding of man's mental and emotional processes. The subject matter deals with physiological bases of behavior and experience, attention, perception, memory, thinking, emotions, intelligence, and personality in terms of the whole person in his social setting.

Soc. Sci. 314 PHILOSOPHY OF SCIENCE (3-0)3

Prof. Edlund

This course analyzes the methods and techniques of inductive and deductive science. Elementary logic is studied and applied to the necessary structure of scientific systems. The great concepts and generalizations which have marked the history of science are reviewed and analyzed, as well as the interrelation of science and general philosophy.

Soc. Sci. 331 or 332 MUSIC APPRECIATION (3-0)3

When requested by a sufficient number of students. — Profs. Katz and Mandell

A survey of music beginning with Beethoven and continuing through modern American composers such as Copland and Piston. Designed to acquaint the student having little or no music background with the composers of the 19th and 20th centuries and their music and styles. The basic purpose of the course is to cultivate a better understanding of music and thereby add to the listening enjoyment of classical and contemporary music. Lecture material will be supplemented by demonstrations and outside listening assignments.

Soc. Sci. 401 or 402 INDUSTRIAL RELATIONS SEMINAR (2-0)2

Prerequisite: Permission of Instructor — Prof. Robertson

Required in Course V

This subject will give a small, selected group opportunities to meet with the instructor and occasional visitors in discussion of current problems in industrial relations. Case material and hypothetical problems in modern labor management will provide the basis for the study by the group.

Soc. Sci. 461 PERSONNEL MANAGEMENT (3-0)3

Prof. Robertson

This subject involves a comprehensive study of modern labor management techniques in the recruiting, selection, training, and placement of members of the

work force. Major emphasis is placed upon the development and maintenance of personnel administration agencies and procedures with the framework of present-day American industry, with special attention to such matters as employee health and safety, welfare and recreation programs, wage and salary administration, training and education, and management relations with labor organizations.

In addition to text material and selected readings, problems will be drawn from actual cases for study and solution by the students. Every effort will be made to acquaint the class with current personnel administration practices in industrial organizations of various types, and to give an appreciation of the importance and magnitude of the labor management function.

Soc. Sci. 463 BUSINESS LAW (3-0)3

Required in Course IX PROF. ROBERTSON

This subject will cover the basic principles of commercial law. Topics studied include: contracts, agency, sales, partnerships, corporation, negotiable instruments, bailments and carriers, insurance, personal property, real property, suretyship and guarantee, and bankruptcy.

Soc. Sci. 465 or 466 MANAGEMENT PROBLEMS (3-0)3

Prerequisite: Permission of Instructor STAFF

A research course for graduate students and selected seniors. Working under the guidance of the instructor, a student investigates an approved topic in the fields of finance, production, or distribution. The findings of the student are presented in formal thesis form. These theses will then be placed in the department library for permanent record.

SYNTHETIC TEXTILES

Syn. 301 FILAMENT YARN PROCESSING (2-0)2

Required in Course V PROF. FREDERICK

This subject deals with the processing of natural and made-man continuous filament fibers from the time they are made available to the textile industry by the manufacturer until they are ready for processing in fabric forms. The nomenclature, purposes, means of accomplishment, and results obtained in the various operations of soaking, winding, throwing, twist setting, coning, and single end sizing are covered in the lectures.

Syn. 302 THROWING PLANT ORGANIZATION (2-0)2

Prerequisite: SYN. 301 PROF. FREDERICK

Required in Course V AND MR. PFISTER

This subject is essentially a continuation of SYN. 301, with the emphasis being placed upon actual plant organization, processing procedures, and quality control. Plant layouts from machinery viewpoints are discussed and assigned for study. Field trips to local plants are an integrated part of the class work.

Syn. 311 MANUFACTURE OF SYNTHETIC FIBERS (3-0)3

Prerequisite: CHEM. 202 PROF. HARRIS

Required in Course V

This subject covers the manufacture of man-made fibers. The rayon, estron, polyamide, polyester, vinyl, protein, mineral and metallic fibers are considered from the standpoint of their manufacturing and economic aspects. The subject is approached with the view of presenting the types of processes and the chemistry (reactions and structures) involved in the manipulation of natural high polymers and the synthesis and manipulation of synthetic high polymers into useful textile fibers.

SYN. 312 STRUCTURE AND PROPERTIES OF SYNTHETIC FIBERS (3-0)3

Prerequisites: CHEM. 202 *and* PHYS. 201 PROF. HARRIS

Required in Course V

In this subject, a study is made of the fundamental structure and properties of the manufactured fibers. The material is developed with the aim to relate the structures of the fibers to their properties and to lay the foundation for the more advanced work covered in SYN. 411-412.

SYN. 322 FILAMENT YARN PROCESSING SURVEY (2-0)1½

Not open to students in Course V PROF. FREDERICK

This survey is divided into two phases, one pertaining to a brief review of the essential methods involved in the manufacture of man-made fibers, including also their basic physical and chemical properties, and the other pertaining to the handling of natural and synthetic fibers in filament form by a throwster for subsequent utilization by a weaving or knitting plant. Some of the lecture time is devoted to laboratory demonstration, and outside assignments constitute a regular part of the subject material.

SYN. 331-332 FILAMENT YARN LABORATORY (0-3) (0-3)2

Prerequisite or Concurrent Subject: SYN. 301

Required in Course V PROF. FREDERICK AND MR. PFISTER

This subject covers the laboratory aspects of SYN. 301, and consists of planned experiments and demonstrations involving the use of throwing machinery and processes by the student. Experiments include various yarn soaking studies, winding, twisting, coning and single end sizing operations, and quality control and power studies.

SYN. 411-412 PROPERTIES AND APPLICATIONS OF SYNTHETIC FIBERS (3-0) (3-0)6

Prerequisite: SYN. 312 PROF. HARRIS

Required in Course V

This subject is a continuation of SYN. 312. Much of the time will be spent on considerations of the fundamental properties of man-made fibers in relation to each other and to the behaviors of the finished textile resulting from these basic properties and the geometry imposed upon the fibers in the textile. To make the material more useful, comparisons are made with natural fibers and their textiles. Recent advances in the manufacture and study of fibers will be discussed whenever necessary to keep the subject matter included in SYN. 311 and 312 up to date.

SYN. 452 SYNTHETIC TEXTILES SEMINAR (2-0)2

Prerequisites: SYN. 302 *and* 411 PROFS. HARRIS AND FREDERICK

Required in Course V

A general discussion of the problems encountered in the synthetic textile field, including economics, manufacture, processing, properties and various aspects of research. Recent advances and projected developments will be covered. Participation by both students and instructors in the seminar develops an objective viewpoint of the subject by the student.

TEXTILES — GENERAL

Tex. 302 FABRICS (3-0)3

Prerequisites: Des. 101 *and* 103 *or* Des. 102 *and* 104
Design Major Prerequisite: Des. 204
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

Prof. Golec

This subject is designed to acquaint the student with many of the important fabric types in use today for wearing apparel, home furnishings, and industrial uses. An analytical discussion is used so that the student may not only identify the fabrics but also understand the significance of the weave, design, yarns, etc., used.

Tex. 311-312 TEXTILE TESTING (2-2) (2-2)6

Prerequisites: Chem. 102 *and* Math. 104
Required in Courses I, II, III, IV, V, VI-E, VI-G, and VII

Prof. Frederick and Mr. Pfister

This subject is designed to provide a foundation for more advanced work in testing, and is of sufficient breadth to benefit those students whose main need is an understanding and appreciation of the scope of testing and evaluation in the textile industry. The subject matter covers an applied approach to the statistical treatment of experimental data, and the basic mechanical or physical, chemical, and optical tools and techniques available to the industry for product control, development, and evaluation. Primary emphasis is placed upon an understanding of the principles involved and an integration of the various phases of textile testing into a unified whole.

Tex. 501 or 502 METHODS OF RESEARCH (2-0)2

Prerequisite: Graduate Students only

Profs. Ball and Harry C. Brown

A seminar to familiarize the student with the philosophy and methods of research, current problems in textile research and of the further use of textile literature.

Tex. 590-591 THESIS RESEARCH

Credits and hours to be arranged

WEAVING

Weav. 201 WEAVING (2-3)3

Required in Course III

Prof. Armstrong and Mr. Woidzik

This semester's work deals with the study of cam looms, their principal and auxiliary motions, including the Warner and Swasey Sulzer weaving machine, a comparison with other types of looms, and a study of weaving terms and cloth defects in the weaving process. Narrow fabric weaving is incorporated in the laboratory exercises.

Weav. 202 WARP PREPARATION (2-3)3

Required in Course III

Prof. Armstrong and Mr. Woidzik

This semester's work covers all methods of warp preparation of all yarns with emphasis upon the conditions favorable to each or combinations of systems.

WEAV. 211 WEAVING FOR MANUFACTURERS (2-2)2½
Required in Courses I, II and V PROF. ARMSTRONG AND MR. WOIDZIK

This subject is similar to WEAV. 201, but utilizes less laboratory time.

WEAV. 212 WARP PREPARATION FOR MANUFACTURERS (2-2)2½
Required in Courses I, II and V PROF. ARMSTRONG AND MR. WOIDZIK

This subject is similar to WEAV. 202, but utilizes less laboratory time.

WEAV. 221 WEAVING FOR ENGINEERS (2-0)2
Required in Course VI-G PROF. ARMSTRONG AND MR. WOIDZIK

This subject, designed for non-manufacturing majors, includes lecture material similar to that in WEAV. 201, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 222 WARP PREPARATION FOR ENGINEERS (2-0)2
Required in Course VI-G PROF. ARMSTRONG AND MR. WOIDZIK

This subject, designed for non-manufacturing majors, includes lecture material similar to that in WEAV. 202, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 301-302 WEAVING (2-3) (2-3)6
Prerequisite: WEAV. 201 PROFS. HOELLRICH
Required in Course III AND MERRILL

This subject covers dobby weaving and includes single and double index, single and double cylinder, chains, timing, and adjusting. Jacquard instruction covers single lift, double lift and double cylinder jacquards, and includes harness tie-ups, card cutting, timing, and adjusting. The instruction on the Crompton and Knowles looms includes 4 x 4 woolen and worsted, automatics and silk. This subject also covers pile cloth weaving, carpet weaving, and leno weaving.

WEAV. 311-312 WEAVING FOR MANUFACTURERS (2-2) (2-2)5
Prerequisite: WEAV. 201 *or* 211 PROFS. HOELLRICH
Required in Courses I, II, and V AND MERRILL

This subject is similar to WEAV. 301-302, but utilizes less laboratory time.

WEAV. 321-322 WEAVING FOR ENGINEERS (2-0) (2-0)4
Prerequisite: WEAV. 201 *or* 211 *or* 221 PROFS. HOELLRICH
Required in Course VI-G AND MERRILL

This subject, designed for non-manufacturing majors, includes the same lecture material as WEAV. 301-302, but includes no laboratory work other than lecture-demonstrations and assignments.

WEAV. 333-334 WEAVING FOR ENGINEERS (1-2) (1-2)3
Prerequisites: DES. 223, 233 *or* DES. 224, 234 PROF. MERRILL
Required in Courses VI-E and VII AND MR. WOIDZIK

This subject covers warp preparation and weaving with emphasis on basic principles, eliminating details. The different systems of warp preparation are described and compared. Each type of loom is described, and the capabilities and limitations of each are discussed. Considerable time is devoted to fabric defects, their cause and correction.

WOOL

Wool 111 or 112 SURVEY OF WOOL MANUFACTURE (2-0)2

Open only to students in Course IV Prof. Kennedy

This subject is designed to give those majoring in chemistry a comprehensive survey of woolen yarn manufacture, worsted yarn manufacture, reprocessed and reused fiber, rag picking, garnetting, stock carbonizing, top making and converting of synthetic tow to sliver on the Pacific Converter.

Wool 211-212 TOP MAKING (2-6) (2-6)8

Prerequisites: Eng. 102 *and* 112 Prof. Koroskys

Required in Course II

This subject covers a study of the preparation of wool and allied hair fibers for processing on all systems of manufacture. Special emphasis is placed on wool buying, grading, sorting, scouring and drying, carbonizing, burr picking, worsted carding, backwashing, gilling, Warner Swasey Pin Drafter, Holdsworth's Gill Reducer, Pacific Evenness Tester, Noble combing, tow to top conversion of synthetic fibers, Pacific Converter, top testing, and a study of classification of commercial tops.

Wool 215-216 TOP MAKING (2-2) (2-2)6

Prerequisites: Eng. 102 *and* 112 Prof. Koroskys

Not open to students in Course II

Required in Course VI-G

This subject covers the same lecture material as Wool 211-212, but the laboratory time is considerably reduced.

Wool 301-302 WOOLEN YARNS (2-4) (2-4)7

Prerequisite: Wool 212 *or* 216 Mr. Brown

Required in Course II

This subject covers woolen system fiber blending, oiling, picking, carding, spinning, twisting, and the handling of reused and reprocessed fiber. Old rags and new clips are graded and sorted. Rag sources are covered as are rag picking, lumping, shredding, garnetting and complete manipulation from reprocessed clips and waste to fiber ready for carding and making into yarn. The processing of wool, manufactured, and synthetic fiber, is studied in theory and practice. Special emphasis is given to details of woolen machinery such as tape and ring doffer type condensers, broadband and Apperly intermediate feeds, automatic weighing feeders, peralta rolls, card drives, and modern mule and ring spinning. The lecture study is augmented with many laboratory experiments and problems which are performed by the student.

Wool 311 or 312 SURVEY OF WOOL MANUFACTURE (3-1)3

Required in Courses I, III, V, VI-E and VII Prof. Kennedy

Not open to students in Course II or VI-G

This subject is designed for those who are not majoring in wool manufacture and presents a comprehensive survey of woolen and worsted yarn, reprocessed and reused fiber, and felt manufacturing processes as they relate to the manipulation of all types of fiber, but with primary emphasis on wool.

WOOL 321-322 WORSTED YARNS (3-5) (3-3)9

Prerequisite: WOOL 212 *or* 216 — PROF. BURTT

Required in Course II

This subject consists of both lectures and laboratory work. It supplements the subject matter given in course 211-212, Top Making. Lectures cover advanced gilling; French combing; top analysis and stapling; worsted yarn manufacture, including drawing, spinning, and twisting for both the English and French systems; colored blending of dyed wool tops, also blending wool top with other fibers. The laboratory work covers each phase of the lecture work. Experiments run concurrently with the lectures. Gilling theories are demonstrated; French combing wool is processed into top on the French comb and both French and English system yarns are manufactured. Fundamentals are stressed in both lectures and laboratory. Experiments are run on super draft drawing and spinning frames.

Considerable new equipment is available for laboratory work, as Whitin Super Draft Rover; Saco-Lowell FS-4 Rover and SS4 Spinning Frame; Whitin French Spinning Frame; six operation set French Drawing, etc.

WOOL 323-324 WOOLEN YARNS (2-2) (2-2)5

Prerequisite: WOOL 212 *or* 216 — MR. BROWN

Required in Course VI-G

Not open to students in Course II

This subject covers the same lecture material as WOOL 301-302, but the laboratory time is reduced.

WOOL 325-326 WORSTED YARNS (3-2) (3-2)7

Prerequisite: WOOL 216 — PROF. BURTT

Required in Course VI-G

Not open to students in Course II

This subject covers the same lecture material as WOOL 321-322, but the laboratory time is considerably reduced.

WOOL 411 WOOLEN AND WORSTED MILL ORGANIZATION (4-0)4

Prerequisites: WOOL 302 *and* 322 — STAFF

Required for Course II

This subject covers a recapitulation of the routine covered in all previous wool textile manufacturing courses. Mill layouts are organized to make definite yardages of specific woolen fabrics using modern machinery on the woolen system of manufacture.

It also summarizes previous textile training by organizing suitable machine layouts for making commercial amounts of top of various grades to cover balanced mill equipment necessary to produce worsted cloth from wool top on both English and French systems of manufacture.

HONORARY DEGREE RECIPIENTS

MASTER OF SCIENCE

COMMENCEMENT 1950

Honorable Paul Andrew Dever
Samuel Pinanski
Edward Robinson Schwarz
Abbot Stevens
George Herbert Varney

COMMENCEMENT 1951

John Henry Dillon
Herman Feldman
Kenneth Russell Fox
Ralph King Hubbard
Francis Wilford White

SPECIAL CONVOCATION—December 1951

Edward Thomas Pickard
Harold Watson Leitch
Walter Julian Hamburger
George Tucker Metcalf
Charles Sawyer

COMMENCEMENT 1952

William Dunford Appel
General Georges Frederic Doriot
Francis Patrick Madden
Harry Riemer
Laurence Frederick Whittemore

DEGREES CONFERRED IN 1952

Bachelor of Science

David Leon Aelion
Donald Winthrop Aldrich
Curtis Carleton Allen
John Harold Allison
*Richard Lee Aronson
*Gordon Lysle Axon
Robert Sutherland Barr
Gerald Francis Barry
Vernon James Beaulier
Marvin Franklin Becker
Robert Ivan Becker
Wilfred Edmond Belanger
*Gilbert Carter Bell
†*Albert Benjamin
Marshall Coles Bird
*Manfred Gunter Bloch
*Milton Boches
*Stephen Joseph Bodor
*John Eberbach Bromley III
Perry Horton Brown
*Kirk Bussiere
William Henry Carroll
Arthur Whittier Claridge
*Laurence Gregory Coffin
Joseph Raymond Deschamps
*Bruce Osborne Dickison
Richard Leonard Draper
Amedee James Dupuis
Richard Thorp Eklund
†Bertram Feinberg
Lawrence Wallace Fisher
Panteleone Samuel Fulginiti
Edward Henry Giard
†Alan Ginsburg
Milton Harvey Gladstone
Charles Edward Gorecki
Earl Joseph Goven
Douglas Francis Grady
Herbert Lawrence Haddad
*Wesley Francis Hixon

Michael Hochfeld
Walter Leo Hochner
Winfred Thomas Hocking
Nicholas Kalantzakos
Ursula Frances Keenan
*Burton Louis Komins
*Michael Joseph Koroskys
Walter Mitchell Koza
Arthur Kupferman
Richard Haynes LaPlante
Laurence Chih-Liang Lee
Sherman Lein
Richard Norman Levenson
*Francis Augustus Lewis
*Roger Alan Lewis
Nicholas Constantine Liacopoulos
Parker Wyman Longbottom
William Paul Lynch
Charles Harris Mack
*Harold John MacLean
†Gaston Christian Majeune
*Warren Eugene Mann
Donald James McCartney
Richard Francis McKeon
Denis Michael McNulty
Edward Mettler
Harold George Mills
Richard Howlett Montgomery
Joseph Charles Morris
Arthur Leo Mullen, Jr.
*Charles David Nelson
Michael Nestervich
John Thomas O'Donnell
Thomas Francis O'Leary
Donald Greenwood Pihl
James Rudman Platt
Frank Walter Polak
Joseph John Prudenti
Miriam Ruth Rogers
*Joseph Alexander Roux
*Stanley Anthony Ruta
Robert John Rutledge, Jr.
*George Angelos Scagos
Donald John Schaaf
Wemyss Ballentine Scott, Jr.
*Fred Boswell Shippee
*Robert Arthur Simmons
Avrum David Smoler
Joseph Michael Stanton, Jr.
*Henry Myron Szczepanik
†Ramon Norman Tessler
Bernard Edmund Therrien
Walter Norman Thibodeau
Mario Carmen Tosone
Lazarus Travis
Bernard Wasserman
Charles Edward Watt, Jr.
Irving Woodman Winn, Jr.
Ralph LeRoy Wise
†Eugene Jackson Wood, Jr.
Jordan P. Yelenides
Eleanor Barbara Zoglio

Bachelor of Science with Honors

*Francis E. Boutin, Jr.
Richard Stacy Brissette
*Harvey Arthur Dersh
*Roland Joseph Desrochers
*Haig Cadmus Donoian
*Florence Patricia Liston
*Thomas Arthur McEwen
*Henry James McKone
*Charles Sylvester Michaels
*Robert Albert Olney
*Margaret Jean Peters
*Daniel Riggs Robson
†*Irwin Jay Roth
*Eric Singer

Bachelor of Science with High Honors

†*Milton Jacob Bernstein
†*Bernard Herbert Engelhardt
*Joel Harvey Grill
*Edwin Collier Sherburne
*Arthur Stefanos Tingas

Master of Science

†*Marvin Aronowitz
Textile Engineering
B.S., Lowell Textile Institute, 1951

Frederick Bedell Bischoff
Textile Engineering
B.S., Lowell Textile Institute, 1951

*Alfred Louis Cate
Textile Chemistry
B.S., Lowell Textile Institute, 1951

*Ruth Elinor Denio
Textile Chemistry
B.S., Lowell Textile Institute, 1951

Paul Maurice DesCoteaux
Textile Engineering
B.S., Lowell Textile Institute, 1951

*John Alden Goodwin
Textile Manufacturing
B.T.E., Lowell Textile Institute, 1940

Gerald Mark Greenberg
Textile Chemistry
B.S., Lowell Textile Institute, 1951

Alfred Kean Hobbs
Paper Engineering
B.S., University of Maine, 1950

George Alexander Jordanides
Textile Engineering
B.S., Bradford Durfee Technical Institute, 1950

William Robert O'Donnell
Textile Engineering
B.S., Lowell Textile Institute, 1951

Henry Leland Pero
Textile Engineering
B.T.E., Lowell Textile Institute, 1941

Clarence James Pope
Textile Manufacturing
B.S., Clemson College, 1941

*Fred Boswell Shippee
Textile Chemistry
B.S., Lowell Textile Institute, 1952

Thomas Chih Hsiung Teng
Textile Manufacturing
A.B., Princeton University, 1950

Nathmal Vyas
Textile Engineering
B.S., Lowell Textile Institute, 1951

†*James Paul Wang
Textile Manufacturing
B.S., Lowell Textile Institute, 1951

*Samuel Anthony Wood
Textile Chemistry
B.S., Lowell Textile Institute, 1951

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* Tau Epsilon Sigma (*Textile Scholastic Society*)
† In absentia

REGISTER OF STUDENTS

GRADUATE STUDENTS

AELION, DAVID LEON, VI, Alexandria Egypt
B.S., Lowell Textile Institute, 1952

BARISH, LEO, IV, New Bedford, Massachusetts
B.S., New Bedford Textile Institute, 1952

BARRY, GERALD FRANCIS, IV, Lowell, Massachusetts
B.S., Lowell Textile Institute, 1952

BHATTACHARYA, UMAKANT, VI, Calcutta, India
L.T.M., Victoria Juilee Technical Institute, 1944

BILBAO, BENJAMIN BAUTISTA, IV, Colombia, S. A.
B.S., Atlantic University, 1949

BOCHES, MILTON, IV, Lowell, Massachusetts
B.S., Lowell Textile Institute, 1952

FINNIE, TREVOR ALEXANDER, IV, Montreal, Canada
B.S., Sir George Williams College, 1951

HALLMAN, THOMAS J., CAPT., U.S.A., VI, Bessemer, Alabama
B.S., Georgia Institute of Technology, 1950

LEVY, JOSEPH BRUNO, IV, Manchester, England
B.S., Manchester University, 1950

LISTON, FLORENCE PATRICIA, IV, Lowell, Massachusetts
B.S., Lowell Textile Institute, 1952

LIU, ANDREW TZE-CHIU, IV, Hong Kong, China
B.S., Indiana University, 1951

LORD, EDWIN LINCOLN, JR., VI, West Medford, Massachusetts
B.S., Lowell Textile Institute, 1950

LUZ, VICTOR JAMES, VI, Lowell, Massachusetts
B.S., Lowell Textile Institute, 1949

OKOYE, CHUKWUEMEKA, VI, Harcourt, Nigeria
B.S., Bradford Durfee Technical Institute, 1952

OLNEY, ROBERT ALBERT, IV, Lowell, Mass.
B.S., Lowell Textile Institute, 1952

ORTIZ, FELIX LUIS, VI, Caguas, Puerto Rico
B.S.M.E., University of Puerto Rico, 1948

SAFIOEN, R., IV, Pamekasan, Indonesia
B.S., S.K.S.J., Technological Institute, 1951

SETTY, ANANTHA KRISHNA, IV, Bangalore, India
B.S., S.K.S.J., Technological Institute, 1950

SHERBURNE, EDWIN COLLIER, IV, Tyngsboro, Massachusetts
B.S., Lowell Textile Institute, 1952

CLASS OF 1953

Abrahams, David Hillel, IV .... Cliffside Park, N. J.
Adell, Robert Godfrey, IV .... Dorchester, Mass.
Adler, Edward Jerome, VI .... New York, N.Y.
Albani, Robert Francis, VI .... Hyde Park, Mass.

Baerwald, Edgar Arendt, II .... Santiago, Chile
Bagdon, Herbert C., VI .... Millburn, N. J.
Barber, Herbert, VI .... Bronx, N. Y.
Barrett, James Joseph, VI .... Waban, Mass.
Baxter, George Lytton, IV .... Briarcliff, N. Y.
Beals, Richard Allen, VI .... Springvale, Maine
Beder, Abner Meyer, VI .... Brooklyn, N. Y.
Bedrosian, Peter, IV .... Haverhill, Mass.
Berger, Stanley, III .... Bronx, N. Y.
Binns, Robert Albert, VI .... North Andover, Mass.
Boutiette, James Paul, VII .... Farnumsville, Mass.
Brandt, Sanford, VI .... Little Neck, N. Y.
Brody, Arnold Allan, VI .... Brooklyn, N. Y.

Carroll, John Neil, V .... Medford, Mass.
Carty, William David, VI .... W. Medford, Mass.
Cobin, Howard Charles, IV .... Brookline, Mass.
Copley, William Morgan, IV .... Lowell, Mass.
Cross, Robert James, VI .... Chelmsford, Mass.

Danza, Lawrence Benjamin, VI .... Keyport, N. J.
Darsch, Charles George, Jr., VI .... No. Plymouth, Mass.
David, John Bernard, Jr., II .... Dudley, Mass.
DeFusco, William Joseph, VI .... Lawrence, Mass.
Demas, Harry John, IV .... Athens, Greece
Devereaux, John Lawrence, II .... West Roxbury, Mass.
Dielendick, Michael, II .... Haverhill, Mass.
Dooley, Donald David, IV .... Lowell, Mass.

Engel, Richard Brom, V .... Elmhurst. N. Y.
Essig, Abe Wilder, VI .... New York, N.Y.

Finegold, Donald Erwin, IX .... Lowell, Mass.
Fishman, Harvey Martin, IV .... Brooklyn, N. Y.
Flamand, Charles David, IV .... Northbridge, Mass.
Flannery, Joseph Patrick, IV .... Lowell, Mass.
Fox, Norman J., IV .... Carmel, N. Y.
Freeman, Arnold Joel, VII .... New York, N.Y.
Froehlich, Eugene Ferdinand, II .... New York, N.Y.

Girard, Roger, Donald, V .... Lowell, Mass.
Godfrey, Robert Steward, VI .... Andover, Mass.
Goodman, Leonard, VI .... Brooklyn, N. Y.
Gosselin, George Joseph, Jr., VI .... Lawrence, Mass.
Goulart, Richard Francis, II .... Cambridge, Mass.
Greenberg, Robert Morris, IV .... Brookline, Mass.
Grubman, Leonard, VI .... Lowell, Mass.

Haley, Lawrence Anthony, VI .... Harvard, Mass.
Hall, Richard King, IV .... Lowell, Mass.
Hamel, Gerald Roland, VI .... Lowell, Mass.
Haralampopoulos, Harry N., IV .... Nashua, N. H.
Harrahy, Donald James, VI .... Worcester, Mass.
Harris, Paul David, VI .... New York, N.Y.
Hilliard, Everett Alvah, Jr., VI .... Lowell, Mass.
Hudson, Ralph Edward, Jr., VI .... Attleboro, Mass.

Kamerman, Kenneth, VI .... Brooklyn, N. Y.
Kaslow, John Francis, VI .... No. Andover, Mass.
Kelleher, Robert Ralph, VI .... Arlington, Mass.
Kelley, Richard Jewett, IV .... Lowell, Mass.
Khoury, Ernest Joseph, IV .... Lawrence, Mass.

Langlais, Roger John, IV .... Lowell, Mass.
Lawrence, George Campbell, II .... Falmouth, Mass.

MacLellan, Neil, Jr., II .... Larchmont, N. Y.
McHugh, Warren Paul, II .... Chelmsford, Mass.
McKniff, Francis, V .... Forge Village, Mass.
Madans, Jerome Irwin, I .... New York, N.Y.
Magnant, Alfred Joseph, V .... Rye, N. Y.
Mulcahy, Robert Edward, V .... Arlington, Mass.

Nachman, Steven Gunther, II .... Kew Gardens, N. Y.
Nelligan, James Anthony, V .... Lowell, Mass.
Nogueira, Alberto DeVasconcelo, I .... Maceio, Alagoas, Brazil
Nordon, Franklin A., VI .... Medford, Mass.
Norman, William Arthur, VI .... Hopedale, Mass

Ostrove, Donald Martin, VII .... Longbeach, N. Y.

Paris, Irin Myron, III .... Fairlawn, N. J.
Peltekian, Stephen A., V .... N. Smyrna, Athens, Greece
Pihl, Carl Frederick, VIII .... Henniker, N. H.
Polak, Walter Frank, V .... Lowell, Mass.
Profio, Robert Michael, IV .... Lowell, Mass.

Ramachandram, Kandaswamy V., I .... Coimbatore, So. India
Randall, Thomas Henry, IV .... Chelmsford, Mass.
Richard, Alfred Joseph, IV .... Gardner, Mass.
Richardson, Maurice W., Jr., VI .... Amsterdam, N. Y.
Robey, Robert Versal, VI .... Chelmsford, Mass.
Robinson, Bertram Robert, Jr., VI .... Lowell, Mass.
Rocha, Manuel Medeiros, VI .... Dedham, Mass.
Rottenberg, Ira Morvay, I .... New York, N. Y.

Saks, Morton Ira, I .... Brooklyn, N. Y.
Sanborn, Roger James, V .... Lowell, Mass.
Schain, Jerry Laurence, V .... Bronx, N. Y.
Scheier, Stanley Charles, VI .... New York, N. Y.
Shantzis, Murray Mark, VII .... New York, N. Y.
Sidelinker, Earl, V .... Lowell, Mass.
Siegal, Donald, VII .... Lowell, Mass.
Smith, Donald Bishop, VI .... Stow, Mass.
Smith, Robert Frank, III .... Lawrence, Mass.
Smith, William Richard, IV .... Tewksbury, Mass.
Stein, Harold Murray, VI .... Lowell, Mass.
Stone, David Charles, VII .... Brooklyn, N. Y.
Swanson, Morris Harvey, VI .... Westford, Mass.

Tewksbury, Charles Goward, VI .... Lowell, Mass.

Uster, William Henry, VII .... Rutherford, N. J.

Velantzas, James Anastas, V .... Lowell, Mass.

Walsh, John Vincent, VI .... Whitinsville, Mass.
Wark, Donald Thomas, IV .... Newton, Mass.
Wiener, Melvin, V .... Brooklyn, N. Y.
Wuester, Erwin August, III .... Riverdale, N. J.

Zagel, Itzhak, VI .... Tel-Aviv, Israel

CLASS OF 1954

Adler, Stephen Emil, II ....Danbury, Conn.
Applebaum, Robert, VI........New York, N.Y.
Asher, Surendra Purshotam, I ....Lenox, Mass.
Austin, David Irving, II ....Reading, Mass.

Baevsky, Marvin Arthur, VI ....Springfield, Mass.
Berkowitz, I. Milton, VI ....New York, N. Y.
Berlyn, Gerald Elliot, VI ....Northboro, Mass.
Berman, Harry, V ....Brooklyn, N. Y.
Bonacci, Edward Louis, VI ....Yonkers, N. Y.
Brier, Daniel Lewis, VI ....Far Rockaway, N. Y.
Broderick, George Joseph, Jr., II ....Clinton, Mass.
Brown, William, VI ....Scranton, Pennsylvania

Carolan, Francis James, IV ....Lowell, Mass.
Cashin, Charles Luther, II ....Chelmsford, Mass.
Cassidy, Robert Thomas, VI ....Lowell, Mass.
Cate, Alan Clifford, VI ....Lawrence, Mass.
Cohen, Ronald Ainesworth, IV ....Lowell, Mass.
Collins, Edward James, VI ....Lowell, Mass.

Dooley, William Eugene, IX ....Lowell, Mass.
Doyle, Russell Paul, IX ....Lowell, Mass.
Ducharme, Jean-Charles, VI ....Orleans, Mass.

Ettenson, Melvin Walter, VI ....Elmont, N. Y.

Fattah, Muwaffaq Nouri, II ....Baghdad, Iraq
Fairfield, Hugh Carlton, II ....Winnipeg, Canada
Fisher, Robert Joseph, II ....E. Paterson, N. J.
Flint, Harry Edwin, VI ....Lawrence, Mass.
French, Kenneth Allan, VI ....Arlington, Mass.
Fulton, Robert Fraser, IX ....Dracut, Mass.

Gabriel, William George, VII ....Flushing, N. Y.
Garvey, Thomas Francis, IV ....Lowell, Mass.
Genereux, Albert Joseph, VI ....Webster, Mass.
Gillie, Stanley James, VI ....Foxboro, Mass.
Ginsburgh, Jerome Herbert, VI ....Brooklyn, N. Y.
Glasheen, Edward Arthur, VIII ....Lowell, Mass.
Good, Lincoln Hovey, VI ....Lexington, Mass.
Gottschalk, Ernest, V ....Kew Gardens, N. Y.
Greenhall, Armand Lawrence, IV ....New York, N. Y.

Hallas, Kenneth Barnes, VIII........Lawrence, Mass.
Hamilton, Henry Ronald, IV ....Woburn, Mass.
Hanson, Donald Baker, VI ....Medford, Mass.
Hebert, Raymond Lucien, IV ....Methuen, Mass.
Henry, Archie Joseph, VI ....Lowell, Mass.
Higgins, Charles James, VIII ....Lowell, Mass.
Hodus, Herbert Jack, IX ....Revere, Mass.
Horowitz, I. Laurence, VI ....Hewlett Valley Stream, N. Y.

Iannazzi, Joseph Louis, VI ....Lawrence, Mass.

Kao, Victor T. C., VI ....Hong Kong, China
Kennedy, William James, Jr., IV ....So. Hadley Falls, Mass.
Kimmel, Arnold Lawrence, VI ....Springfield, Mass.
Kinney, Georgina Betty, IV ....Lowell, Mass.
Kupferschmid, Bernado, VI ....Buenos Aires, Argentina
Kyriacopoulos, Vasilios, VI ....Lowell, Mass.

Lanthier, Paul Francis, IV ....Dracut, Mass.

Laurion, Tristan Arnold, IV .... Dracut, Mass.
Legge, Robert Wayne, IV .... N. Easton, Mass.
Leventhal, Bernard Alan, VII .... White Plains, N. Y.
Libbey, Arthur Joseph, Jr., IV .... Lawrence, Mass.
Lind, Herbert Clark, VIII .... Chelmsford, Mass.
Lorman, Robert John, IX .... Tyngsboro, Mass.
McDonagh, Paul Mathew, IV .... Lowell, Mass.
Manuila, Dan Camil, VI .... New York, N. Y.
Marchand, Albert Joseph, IX .... Lowell, Mass.
Mavro, Othon John, II .... Allston, Mass.
Nichols, Donald Stanley, VI .... Upton, Mass.
O'Sullivan, James Francis, IV .... Groton, Mass.
Pecci, Raymond P., IV .... Lawrence, Mass.
Pelletier, Andre Joseph, IV .... Lowell, Mass.
Pelliccione, Robert Joseph, VIII .... Lawrence, Mass.
Quealy, Thomas Stephen, IV .... Lowell, Mass.
Reardon, William John, Jr., VI .... Framingham, Mass.
Riley, Charles Philip, Jr., IV .... Lowell, Mass.
Robbins, Walter Archibald, II .... Danville, Virginia
Robelo, Cesar Augusto, VI .... Managua, Nicaragua
Rogers, Donald Francis, VII .... Lowell, Mass.
Rushton, Warren Stanley, VIII .... Lowell, Mass.
Sargent, Thomas Joseph, VIII .... Lowell, Mass.
Scarponi, Othello, VI .... Somerville, Mass.
Siegel, Gerald Howard, VI .... New York N. Y.
Smith, Charles Augustus, IV .... Lowell, Mass.
Solkoff, Sidney, VI .... Brooklyn, N. Y.
Steinsapir, Abby Dolber, VI .... Santiago, Chile
Sturm, Charles Frank, VI .... Lakewood, N. J.
Swift, Robert Evan, VI .... Tiverton, R. I.
Tanzer, Kenneth Elliott, IV .... New York, N. Y.
Tournas, Arthur, VIII .... Dracut, Mass.
Waugh, Robert William, III .... Andover, Mass.
Weiser, Abram, V .... Lawrence, Mass.
Weissenborn, Florian Julius, I .... Buenos Aires, Argentina
Whitney, Lloyd Elmore, VI .... Brockton, Mass.
Woessner, Harry Norman, VI .... Lowell, Mass.
Zalechowski, Edwin, VIII .... Lawrence, Mass.

CLASS OF 1955

Barrett, Robert Wallace, V .... Malden, Mass.
Bass, Lawrence Maury, VI .... Hillside, N. J.
Berger, Joel, IV .... Brooklyn, N. Y.
Bicknell, Roger Willard, V .... Chelmsford, Mass.
Boches, Gerald Edwin, IV .... Dorchester, Mass.
Bodenhorst, Piet Benno, IV .... Ambato, Ecuador
Bogart, Joel, II .... Brooklyn, N. Y.
Brodeur, Norman Gille, VI .... Lowell, Mass.
Brosnan, William Thomas, IV .... Newton Highlands, Mass.
Brown, William Watson, V .... Lowell, Mass.
Canovai, Peter Clement, IV .... Rutherford, N. J.
Casey, James Paul, IV .... Lowell, Mass.
Chiklis, Charles Koulias, IV .... Lowell, Mass.

Chingros, Chris, IV .... New York, N. Y.
Cohen, Allen Charles, VI .... Rosedale, N. Y.
Cooperman, Alan Norman, VI .... Clinton, Mass.
Crean, Daniel Francis, IV .... Stoughton, Mass.

Ectman, Elliot Israel, III .... Winthrop, Mass.
Eddy, Robert George, V .... Roselle Park, N. J.
Eisenberg, Jules Saunders, II .... New York, N. Y.

Fagan, Eric Francis, V .... Lowell, Mass.
Faust, Charles Allan, VIII .... Lowell, Mass.
Fletcher, Emerson Kennard, VI .... Westford, Mass.
Foye, Raymond Leo, VI .... Lowell, Mass.
Frank, Floyd Ivan, VI .... Elizabeth, N. J.
Frazee, Donald William, VI .... Lowell, Mass.
Freeman, Joseph Francis, Jr., III .... Ayer, Mass.
Frei, William Frederick, VI .... Teaneck, N. J.

Gallagher, Gerald Thomas, IV .... Chelmsford, Mass.
Galvin, John Blake, IV .... Lowell, Mass.
Ganz, James Bernard, VI .... Brooklyn, N. Y.
Geary, Nancy, J., IV .... Chelmsford, Mass.
Gilet, Albert James, Jr., II .... Lowell, Mass.
Gostanian, Edward, VI .... Watertown, Mass.
Green, Gerard Kennedy, VII .... Lowell, Mass.
Guimaraes, Juliovito, Pentagna, I .... B. Horizonte, M. Gerais, Brazil

Hall, Robert Ayer, V .... Lowell, Mass.
Hamel, Norman Alfred, IV .... Dracut, Mass.
Hardy, Frank Raymond, VI .... Chelmsford, Mass.
Harrington, Paul A., IV .... Lowell, Mass.
Hayes, Charles Edward, VI .... Lansdowne, Pa.
Heintz, Kenneth George, III .... Monson, Mass.
Hince, Lawrence, VIII .... Lowell, Mass.
Hoffman, Theodore, VI .... Brooklyn, N. Y.
Horowitz, Arnold Joseph, II .... Worcester, Mass.
Houston, Bernard Charles, VI .... Lowell, Mass.
Howarth, Donald George, VI .... Hartford, Conn.
Hyman, Edgar Allan, III .... Fall River, Mass.

Iannazzi, Fred Domenic, VIII .... Lawrence, Mass.

Kane, Edward Hugh, VIII .... Lowell, Mass.
Kappler, Francis Robert, IV .... Lowell, Mass.
Karp, Herbert Eugene, VIII .... Lowell, Mass.
Katsaros, Stergios George, VI .... Lowell, Mass.
Kenney, Elaine Louise, III .... Lowell, Mass.
Kiluk, Frank Jo, IV .... Lowell, Mass.
Kleeman, Melvin Charles, VII .... Kew Gardens, New York
Knox, James Allison, Jr., VII .... Reading, Mass.
Krause, George W., VI .... Brooklyn, N. Y.
Krouss, Stuart, IV .... New York, N. Y.

Langer, Alan Hilton, V. .... Brooklyn, N. Y.
Larose, Francis Alphonse, VIII .... Lowell, Mass.
Leavitt, Stanley James, VI .... Springfield, Mass.
Legow, Donald Martin, VI .... Newark, N. J.
Leipzig, Paul E., VII .... Brooklyn, N. Y.
Leirner, Nelson, VI .... San Paulo, Brazil
Lolos, Demetrios Speros, VI .... Lowell, Mass.
Lutz, Robert John, VI .... Dracut, Mass.

McKone, Vincent Joseph, IV .... Lowell, Mass.

McNamara, John Joseph, IV ....Lowell, Mass.
Madden, Rodney Michael, VI ....Woburn, Mass.
Marcus, Allen C., I ....Long Beach, N. Y.
Missry, Leon, VI ....Providence, R. I.
Moissonnier, Raymond Amede, VI ....Holyoke, Mass.
Morway, Richard Joseph, IX ....Lawrence, Mass.
Moser, Paul John, VI ....Clifton, N.J.

Nagle, Robert Thomas, VIII ....Lowell, Mass.
Nicalek, John Louis, IV ....Lawrence, Mass.

O'Heir, Albert Edward, VI ....Lowell, Mass.
Ouellette, Normand Bernard, III ....Lowell, Mass.

Palm, Gilbert Rogers, VII ....Plainfield, N. J.
Pappaioanou, George James, VI ....Lowell, Mass.
Perkins, Guy Emmanuel, V ....Holyoke, Mass.
Peterson, Albert Carter, VI ....Lawrence, Mass.
Petkiewicz, Chester John, IV ....Dracut, Mass.
Pokraka, Earl Edward, IV ....Providence, R. I.
Ponty, Howard Davis, II ....Worcester, Mass.
Powell,Henry Joseph, VIII ....Lowell, Mass.

Reilly, John Rowen, Jr., II ....Brookline, Mass.
Rekant, Seymour, VII ....Providence, R. I.
Riecks, David Edman, VI ....Billerica, Mass.
Robelo, Fernando Jose, VI ....Managua, Nicaragua
Rogers, David Eldridge, VI ....Wakefield, Mass.
Rosen, Jerome Hirsch, VI ....Long Beach, N. Y.

Samson, Clifton Rockwell, VI ....Eaton, Ohio
Sanghrajka, Jayantilal K., IV ....Bombay, India
Sarmiento, Pedro David, IV ....Ayer, Mass.
Scaringi, John Herbert, IV ....Pinehurst, Mass.
Shay, David Henry, IV ....Beverly, Mass.
Sheldon, Edward Bradley, VI ....Easthampton, Mass.
Silverman, Lewis, VI ....Brooklyn, N. Y.
Solomon, Kalman, VII ....Notre Dame de Grace, Canada
Stanley, George Aloysious, IV ....Lowell, Mass.
Stanley, James Edward, II ....Lowell, Mass.
Stein, Stanley William, VI ....Brooklyn, N. Y.
Stone, Carl Alvin, II ....Rochester, N. H.
Strzelewicz, William Bernard, Jr., VI ....Webster, Mass.

Tang, Michael Tsin-Chien, I ....Hong Kong, China
Torchia, David Francis, IV ....Stottville, N. Y.
Twarog, John Louis, IV ....Dracut, Mass.

Velantzas, Fotine, IV ....Lowell, Mass.
Vinios, John Louis, VI ....Lowell, Mass.

Wagner, Robert Elliott, VI ....New York, N. Y.
Walshaw, Robert Mahlon, VI ....Gretna, Virginia
Welch, Eugene Francis, IX ....Lowell, Mass.

CLASS OF 1956

Adelsohn, Martin D., VI ....Brooklyn, N. Y.
Aldrich, Richard Bruce, III ....Tewksbury, Mass.
Annaian, Yervant Edward, VI ....Lawrence, Mass.

Bagshaw, David Ladd, VI ....Salem, N. H.
Banker, Anilkumar R., I ....Bombay, India

Bauman, Myron J., VI .... Providence, R. I.
Berkowitz, Edmund Marvin, VI .... New York, N. Y.
Bernard, John Gregory, VI .... Methuen, Mass.
Bourret, Roger F., IV .... Lowell, Mass.
Boyle, John Francis, Jr., V .... Lowell, Mass.
Briden, Robert Xavier, III .... Clinton, Mass.
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Byron, Charles M., VII .... Lowell, Mass.

Chandonnet, Victor Louie, VI .... Lowell, Mass.
Clapper, Lynn Edward, VIII .... Lowell, Mass.
Coates, Donald Preston, VI .... Chelmsford, Mass.
Cogger, Francis, P., VI .... Lowell, Mass.
Condon, James Allan, IV .... Lowell, Mass.
Cotton, Harold Nissen, VI .... Worcester, Mass.
Crowe, Robert Emmet, IX .... Lowell, Mass.
Cryan, Jean Ann, III .... Lowell, Mass.
Czekanski, Marcella Stasia, III .... Dracut, Mass.

Dadoly, Nicholas, VIII .... Dracut, Mass.
Daigle, Claudette E., IV .... Gardner, Mass.
Daoulas, James, VIII .... Dracut, Mass.
Davies, James Thomas, IV .... Lawrence, Mass.
Davis, Richard Harding, Jr., II .... Albany, N. Y.
Dellerson, Arthur Horman, VI .... Miami Beach, Florida
Denio, Alan A., IV .... Lowell, Mass.
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Desmarais, Edward J., VIII .... Lowell, Mass.
Desrosiers, Clarence E., VI .... Lawrence, Mass.
Devereaux, Richard Francis, VI .... W. Roxbury, Mass.
Doyle, James Tobin, IX .... Lowell, Mass.
Dufour, Normand Bernard, VIII .... Dracut, Mass.
Dunigan, Paul Henry, IV .... Graniteville, Mass.
Dunn, Carol Ann, III .... Lowell, Mass.
Durand, Charles L., IV .... Lowell, Mass.
Durkee, Robert H., VIII .... Chelmsford, Mass.
Dursin, Marcel M., VI .... Woonsocket, R. I.

Fuller, Wallace J., VII .... Woodmere, N. Y.
Fisher, William Bassett, II .... Franklin, N. H.
Fitzgerald, Edward Francis, IV .... Dorchester, Mass.
Fox, Richard Allen, VIII .... Lowell, Mass.

Gardiner, Robert Arthur, IV .... Reading, Mass.
Gentle, Frank H., IV .... Lowell, Mass.
Gormley, Paul Leo, VI .... Dracut, Mass.
Greene, Norman Graces, VI .... Lowell, Mass.
Grevelis, Theodore George, VII .... Peabody, Mass.
Guild, Curtis Arthur, VI .... Tyngsboro, Mass.

Haigh, John Michael, VIII .... No. Andover, Mass.
Hanlon, David Ernest, VI .... Woburn, Mass.
Hogan, Francis Joseph, VII .... Dedham, Mass.
Hunt, Susan Louise, IV .... Billerica, Mass.

Jacques, Pierre Joseph, VIII .... Lowell, Mass.

Kaplan, Dennis Stanley, VII .... New York, N. Y.
Kaplan, William, VI .... Hillside, N. J.
Kaye, Harvey, VI .... Brooklyn, N. Y.
Keenan, Leo John, VIII .... Dracut, Mass.
Keenan, Robert Herman, IV .... Lowell, Mass.

Keohane, James Michael, VII ..... Lowell, Mass.
Killeen, Allen John, VIII ..... Lowell, Mass.
Klimpl, Fred Emil, VI ..... Bayonne, N. J.
Knight, Perley Stearns, VI ..... Tyngsboro, Mass.
Koza, Edward Robert, VI ..... Lowell, Mass.

LaFrance, Richard Eugene, IX ..... Lowell, Mass.
Lamprey, Philip Shepard, IV ..... E. Chelmsford, Mass.
Landry, George Leon, VI ..... Lowell, Mass.
Law, Paul Arthur, IV ..... Lowell, Mass.
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Lewis, George Clinkon, VI ..... Allenstown, N. H.
Libbey, Frances Theresa, IV ..... Lawrence, Mass.
Long, Edward A., VI ..... Lowell, Mass.

McGlinn, Patricia Mary, IV ..... No. Andover, Mass.
McGrath, Paul James, VI ..... Lowell, Mass.
McKenna, David J., IX ..... Lowell, Mass.
McLaughlin, John James, IX ..... Belmont, Mass.
McPherson, James Richard, VI ..... Beverly, Mass.
Mahnken, Robert Charles, VI ..... Ozone Park, N. Y.
Mahoney, William Patrick, V ..... No. Billerica, Mass.
Marriner, Thomas Eaten, II ..... E. Pepperell, Mass.
Melanson, Leonard Moses, VIII ..... Westfield, Mass.
Minott, Ernest Franklin, IX ..... Peabody, Mass.

Nair, Binod Uumar, I ..... Bombay, India

Obear, Frederick Woods, IV ..... Chelmsford, Mass.

Paras, Arthur, IX ..... Woburn, Mass.
Peck, David Marvin, VII ..... Great Neck, N. Y.
Peckham, Richard L., IX ..... Norwich, Conn.
Pedrick, William Henry, IV ..... Malverne, N. Y.
Perlstein, David Bruce, I ..... Teaneck, N. J.
Perrott, Donald Nicholas, VI ..... Bennington, Vermont
Perry, Jack Austin, V ..... Billerica, Mass.
Plumley, Harold A., IX ..... Lowell, Mass.

Raudelunas, Francis Anthony, IV ..... Lowell, Mass.
Remler, Elliot, VI ..... Brooklyn, N. Y.
Ricard, Roderick Rene, Jr. ..... Lowell, Mass.
Rochelson, Karol, VI ..... Brooklyn, N. Y.
Roddy, John Thomas, V ..... Lowell, Mass.

Samaras, Peter Nicholas, VIII ..... Lowell, Mass.
Sawyer, Richard Earl, IV ..... No. Billerica, Mass.
Schacher, Ronald, IV ..... Honduras, Central America
Schwartz, Eugene Philip, V ..... Providence, R. I.
Sciacca, Raymond Patrick, VI ..... Methuen, Mass.
Shanley, Edward Francis, VIII ..... Lowell, Mass.
Shaughnessy, Lawrence Girard, IV ..... Lowell, Mass.
Sheehan, George Joseph, IV ..... Lowell, Mass.
Sidelinker, Leonard, III ..... Lowell, Mass.
Slatkin, Edgar Warren, VI ..... Brooklyn, N. Y.
Smukler, Mayer David, VII ..... Brooklyn, N. Y.
Snyder, Edward John, Jr., VII ..... W. Brookfield, Mass.
Snyder, Roger Francis, IV ..... W. Brookfield, Mass.

Taplin, Francis Joseph, VI ..... Haverhill, Mass.
Teague, Charles Stewart, VII ..... Somerville, Mass.
Teubal, Miguel Lucien, III ..... Buenos Aires, Argentina

THOMPSON, ROBERT EDMUND, III ....Rockland, Mass.
TIERNEY, OWEN CRAIG, IV ....Lowell, Mass.
TOUSSIEH, SOLLY, VI ....New York, N. Y.
VILADOMS, JORGE ANTONIO, VI ....M. Everest, Mexico
WALLACE, DONALD ROGER, VII ....Ayer, Mass.
WALSH, ALAN RICHARD, VI ....Forest Hills, Mass.
WALSH, JAMES FRANCIS, II ....Lawrence, Mass.
WALSH, LAURENCE BROBROOK, III ....Lowell, Mass.
WATERMAN, CHARLES JEFFREY, VI ....Lowell, Mass.
WHITE, JOHN ROBERT, II ....Andover, Mass.
WHITE, RUSSELL HERBERT, VII ....Lowell, Mass.
WOODSIDE, A. CLIFFORD, 3D, IV ....Reading, Mass.
YANNALFO, SYLVESTER PAUL, JR., IV ....Haverhill, Mass.
YOACHIMCIUK, WILLIAM VIRGIL, JR., ...Lowell, Mass.
ZAMES, ISRAEL IRA, VI ....New York, N. Y.
ZINS, HOWARD M., V ....Brooklyn, N. Y.

SPECIAL STUDENTS

FARNSWORTH, JAMES D. ....Lowell, Mass.
GOLDSMITH, ELLIOTT BERNARD ....New York, N. Y.
HUSSON, TERESA ....Lowell, Mass.
KWOK, DAVID CHIH-WEI ....Hong Kong, China
MACIEJEWSKI, WALTER EUGENE ....Norwich, Connecticut
OXER, JERRY ....Bronx, N. Y.
PAREKH, SHASHIKANT S. ....Bombay, India
PILLING, DOUGLAS RICHARD ....Rossendale, England
ROY, ROLAND L. ....Manchester, N. H.
SCARBOROUGH, EDGAR, JR., ...Lowell, Mass.
STARR, FRED ....Brooklyn, N. Y.
YOUNIS, MOHAMMED TAYYEB HAJ ....Mosul, Iraq
YU, PAUL, U. C. ....Taipei, Formosa

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JRRICULUM BULLETIN

May, 1953

BULLETIN

of the

Lowell Technological Institute of Massachusetts

LOWELL, MASS.

1953-1954

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Textile and Colonial Avenue

EVENING DIVISION

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TRUSTEES

OF THE

LOWELL TECHNOLOGICAL INSTITUTE OF MASSACHUSETTS

OFFICERS

TRUSTEES

PRESENT INCUMBENTS, TERM ENDING JUNE 30, 1953

PRESENT INCUMBENTS, TERM ENDING JUNE 30, 1954

PRESENT INCUMBENTS, TERM ENDING JUNE 30, 1955

ADMINISTRATION

PRESIDENT

Martin J. Lydon, A.B., A.M. . . . . . Montview Road, Chelmsford

DIRECTOR OF EVENING DIVISION

Charles F. Edlund, S.B., Ed.M. . . . . . 68 Baldwin Street, Lowell

ASSISTANT DIRECTORS OF EVENING DIVISION

Robert J. Peirent, B.S. . . . . . . 663 Hildreth Street, Dracut
Charles L. Daley, B.T.E. . . . . . . 465 Pine Street, Lowell

BURSAR

Wallace C. Butterfield, B.S. . . . . . 13 Sylvan Avenue, Chelmsford

EVENING DIVISION REGISTRAR

Dorothy A. Michael . . . . 92 Hastings Street, Lowell

CALENDAR — 1953–1954

First Semester

September 24, 29, 30, 1953, 7–8:30 P.M.	Registration
October 5, 1953, Monday	Classes begin
October 12, 1953, Monday	Columbus Day, Holiday
November 11, 1953, Wednesday	Armistice Day, Holiday
November 25, 26, 1953, Wednesday and Thursday	Thanksgiving Recess
December 21, 1953, Monday	Christmas Recess begins
January 4, 1954, Monday	Classes resume
January 28, 1954, Thursday	End of First Semester

Second Semester

January 26, 27, 28, 1954, 7–8:30 P.M.	Registration
February 8, 1954, Monday	Classes begin
February 22, 1954, Monday	Washington's Birthday, Holiday
April 14, 1954, Wednesday	Easter Recess begins
April 21, 1954, Wednesday	Classes resume
May 27, 1954, Thursday	End of Second Semester

GENERAL INFORMATION

Entrance Requirements

Entrance requirements vary with the course or subject selected. For subjects taken toward a certificate, the requirement, in general, is graduation from grammar school or presentation of equivalent education. For those students desiring to obtain a diploma from the Evening Division, the requirement is graduation from a recognized high school or presentation of equivalent study or achievement.

Evidence of equivalent education, in place of grammar or high school graduation may be given by taking an examination, usually on registration evenings, or by presenting records of various courses taken elsewhere. Those who are not high school graduates but wish to work toward a diploma may satisfy the requirement by taking evening courses at the Institute, consisting usually of Mathematics, English, Physics and Chemistry.

Registration

Students must register by filling out the necessary forms and paying fees, before attending classes. Registration is held on the dates indicated in the calendar above or on the opening nights of the various classes. Much time will be saved by registering on the evenings set aside for that purpose.

Sessions

Classes are held on Monday, Tuesday, Wednesday and Thursday evenings each week, usually from 7 to 9 P.M., although other hours are sometimes required in particular subjects. The subjects offered require from one evening per week to three evenings per week. (See subject schedules).

The scheduled nights for the various subjects in the following pages are tentative and may be altered in a few cases.

Fees and Deposits

A registration fee of one dollar per semester is required of *all* students, in addition to tuition and other charges.

Tuition for all evening courses is free to residents of Lowell, provided a certificate of residence is filed with the school office. Such certificates may be obtained from the Election Commission, City Hall, Lowell. However, registration may be completed prior to filing this certificate with the office.

To non-residents the tuition fees per semester are as follows:

One evening per week courses	$5.
Two evenings per week courses	$10.
Three evenings per week courses	$15.

Students electing any chemistry course that requires laboratory work must pay a laboratory fee of $10 per semester in addition to their tuition. Those electing Machine Shop Practice must pay a laboratory fee of $5 per semester in addition to tuition. These fees are to cover supplies and normal breakage. Any excessive breakage will be billed directly to student and must be paid before credit can be obtained for the course. No portion of these laboratory fees will be returned except as provided in the section on refunds. These laboratory fee requirements apply to *all* students registering in these courses whether they are residents or non-residents of Lowell.

Regularly enrolled day school students at the Lowell Technological Institute may take evening courses without charge for tuition but must pay the one dollar registration fee and the laboratory fee where the latter is required.

All fees must be paid in full at the time of registration.

Refunds

Students dropping out of a course any time before the end of the first five weeks of the semester may obtain a refund of one-half their tuition and one-half of any laboratory fee paid, provided application for such refund is made prior to the expiration of the first five weeks. No refunds of any kind will be made after the first five weeks. The registration fee of one dollar will not be returned in any case unless the course is canceled.

Late Registration

No new registrations or course changes will be accepted for any course after the first three weeks of classes have been held in that course.

Veterans

All Lowell Evening Division courses are approved for study under the G. I. Bill of Rights. Those still entitled should secure a certificate of eligibility from the Veterans' Administration before registering. Books and supplies cannot be obtained without it. A letter from the Veterans' Administration, showing application for a certificate has been made, will be accepted for temporary admission to classes but must be followed by a certificate of eligibility or tuition charges will be made to the student. Veterans who have been pursuing a course of study at the Evening Division under its provisions may complete their program subject to V. A. regulations.

Books and Supplies

Students must provide their own books, paper, drawing materials, etc., and pay for any breakage or damage of school equipment that they may cause.

Student supplies will be sold by the school cooperative store each evening school night from 6:45 to 8:15 P.M.

Size of Classes

No first year course will be given unless at least 10 men register for it and in a few instances, more than that number. Advanced courses will usually, but not necessarily, be given, regardless of number.

Inclement Weather

Due to difficulties in notifying in time students and instructors who reside at a distance, evening school will not be cancelled for reasons of weather at any time.

Attendance

Students must attend 70% of all classes held in a course in order to receive credit for the course. Four unexplained absences in a row will result in the student being automatically dropped from the rolls.

Diplomas and Certificates

Students satisfactorily completing individual courses, ranging in length from one to three years, will be awarded a certificate. (See listing of courses on following pages).

The diploma of the Evening Division will be awarded to students completing a prescribed group of courses, requiring, in general, three nights per week for 4 to 5 years. At present, diploma courses are being offered in Textile Chemistry and Dyeing, Cotton Manufacturing, Woolen Manufacturing and Worsted Manufacturing. The requirements for a diploma are listed elsewhere in the bulletin but are subject to alteration or change as the Institute deems advisable. In general, however, they should not differ materially from the programs shown.

All students working toward a diploma should contact the Director of Evening Division as soon as possible to work out a schedule of courses suitable to their objective.

COTTON AND STAPLE SYNTHETIC YARNS

Staff

Asst. Prof. John A. Goodwin, B.T.E., M.S., in charge of department

Asst. Prof. Clarence J. Pope, B.S., M.S.

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Cotton Yarns	M-111	Tues. & Thurs.	None
Cotton Yarns	M-113	Mon. & Wed.	M-112

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Cotton Yarns	M-112	Tues. & Thurs.	M-111
Staple Fibers	M-114	Mon. & Wed.	M-113

Description of Above Courses

Cotton Yarns M-111. First semester of cotton yarn manufacture. Topics covered include: properties and characteristics of raw cotton, cultivating, ginning and marketing of raw cotton, mixing, opening and picking, and carding.

Cotton Yarns M-112. Second semester of cotton yarn manufacture. Topics covered include: combing, drawing, regular and long draft roving.

Cotton Yarns M-113. Third semester of cotton yarn manufacture. Topics covered include: spining, spooling, winding and twisting.

Staple Fibers M-114. This course covers the processing of staple synthetic fibers on the cotton system and the modifications of cotton type equipment to handle these fibers. The lectures are supplemented with laboratory work.

Certificates

The Cotton Yarns certificate will be awarded for the successful completion of M-111, M-112, M-113 and M-114.

Diploma in Cotton Manufacturing

A diploma in cotton manufacturing will be awarded to those completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening Division Director.

A student desiring to work towards an Evening School diploma should inform the Evening Division Registrar as soon as possible so that he may be properly advised as to what courses to schedule in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

While the work load in individual years will vary, a student could expect to complete this program in four years if he attends an average of three nights per week.

This group of courses provides a background in all the basic processes in a cotton mill and is designed for the student who wishes to prepare himself for higher supervisory and executive positions.

The minimum requirement for the diploma in Cotton Manufacturing is a total of 720 classroom hours or an average of three evenings per week for four years.

The following courses must be taken: Cotton Yarns M-111, M-112, M-113; Staple Fibers M-114; Elementary Textile Design M-351; Cotton and Synthetic Design M-327; Cotton Design M-328; Power Weaving and Warp Preparation M-332; Cotton and Synthetic Finishing M-718; Textile Testing E-671.

The above courses total 600 classroom hours. The remaining 120 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group.

Textile and Engineering Courses: Knitting M-115; Loom Fixing M-324; Power Weaving M-333; Quality Control E-646; Mechanism E-630 and other courses of a similar nature by approval of the Director of Evening Division.

Business and General Courses: Foremanship G-653; Industrial Relations G-655; Industrial Psychology G-681; and other courses of a similar nature by approval of the Director of Evening Division.

KNITTING

Staff

Assoc. Prof. Nathaniel E. Jones

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Knitting	M-115	Tues. & Thurs.	None

Description of Above Course

Knitting M-115. This is a general course in the manufacture of knitted fabrics and garments from all types of yarns. It includes yarns and yarn sizing. A one semester certificate will be awarded for its successful completion.

WOOL AND STAPLE SYNTHETIC YARNS

Staff

Prof. James H. Kennedy, Jr., B.T.E., M.S., in charge of department
Asst. Prof. J. Frederic Burtt, B.T.E.
Asst. Prof. Michael J. Koroskys, B.S.
Mr. Russell L. Brown, Jr., B.S.
Mr. James T. Simpson

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Textile Mechanism and Calculations	M-201	Thurs.	None
Technology of Natural and Man-made Fibers	M-202	Mon. & Tues.	None
Reprocessed and Reused Fiber Manufacture	M-203B	Mon.	M-201 & M-202
Synthetic Yarn Manufacture on Woolen System	M-203C	Tues.	M-203A
Worsted and Synthetic Yarn Manufacturing	M-205	Wed. & Thurs.	M-204
Top Mill Organization	M-208	Thurs.	M-204

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Yarn Manufacturing by Woolen System	M-203A	Mon. & Tues.	M-201 & M-202
Wool and Staple Synthetic Top Manufacture	M-204	Mon. & Tues.	M-201 & M-202
Wool and Staple Synthetic French Combing	M-206A	Thurs.	M-204
Wool and Staple Synthetic Yarn Manufacture on the French System	M-206B	Wed.	M-204
Tow to Top-Synthetic and Man-made Fiber	M-207	Thurs.	M-204

Description of Above Courses

Textile Mechanism and Calculations M-201. A short course covering the necessary mechanisms and mathematics required for an understanding of textile machines. It covers such topics as: pulleys, cones, gears, levers, cranks, revolutions, surface speed, constants, ratio, proportion, formulae, slide rule, etc. It is a prerequisite for all other courses in the Department. Students who have had some college mathematics may be given credit for this course. Mostly lectures but occasionally demonstrations are given in the laboratories.

Technology of Natural and Man-made Fibers M-202. This course covers types of sheep and wool. Wool buying, selling, grading, sorting, scouring. Other animal fibers as mohair, alpaca, camel, vicuna, etc. Man-made fibers as rayon, nylon, orlon, etc. Identification, tests, uses, properties. Theory and basic principles of yarn making by all systems. Explanation of mule spinning, frame spinning, roller drawing, porcupine drawing, pressed felt manufacture, etc. Mostly lectures but includes a few laboratory demonstrations.

Yarn Manufacturing by Woolen System M-203A. This course covers the conventional woolen yarn system of picking and blending, carding and spinning, on both the mule and frame. Instruction includes machine descriptions, adjustments, settings, maintenance, and processing techniques. The course is chiefly lecture but there are some laboratory demonstrations.

Reprocessed and Reused Fiber Manufacture M-203B. This course covers the sources of reclaimed fiber, the sorting of raw materials and the carbonizing of rags. The student is then taken through the rag picking, lumping, shredding, and garnetting processes of reducing raw materials to a fibrous condition. The application of the Wool Products Labeling Act is also covered. The course consists basically of lectures, with some laboratory demonstrations.

Synthetic Yarn Manufacture on the Woolen System M-203C. This course is designed to familiarize the student with the problems of processing synthetic fibers into yarn on woolen system machinery. The course covers basic properties of synthetic fibers, techniques of processing, machine set-up, and special adjustments. The course is chiefly lecture work but there are some laboratory demonstrations.

Wool and Staple Synthetic Top Manufacture M-204. This course covers the manufacture of wool or man-made fibers as cut staple rayon or synthetics into top using some or all of the following operations: worsted type carding, backwashing, open and intersecting gilling, Noble Combing, Warner Swasey Pin Drafters, Holdsworth Gill Reducers; mostly lectures but sample lots of wool or synthetic fiber or blends are usually run in the laboratory as time permits.

Worsted and Synthetic Yarn Manufacture M-205. This course covers yarn making of wool or synthetic fiber or blends on the modified Bradford or English type of machinery. Roller drawing machines, worsted spinning frames, twisters, winders are studied as well as the newer short cut systems using the Warner Swasey Pin Drafter, Holdsworth Gill Reducer, etc. Other spinning systems as Bird System, American System, Ambler, Saco-Lowell Draftall, Whitin Super-Draft are studied. Mostly lectures but some demonstrations and sample lots of synthetics and wool or blends of all types of fibers are made into yarn in the laboratory when time permits. Spinning will cover all phases of flyer, cap, ring, direct and centrigufal systems. Production, scheduling and routing problems will be discussed with actual mill procedures as subject matter.

Wool and Staple Synthetic French Combing M-206A. This course covers the combing of shorter wools or synthetics on the so-called French Comb. Advanced intersecting gilling and blending of wool with other fibers and blends of synthetics are studied. Mostly lectures but modern equipment is available in the laboratory and usually small lots of wool, or synthetics or blends are run.

Wool and Staple Synthetic Yarn Manufacture on the French System M-206B. This course covers the manufacture of wool or synthetics or blends into a French worsted type yarn. Operations studied are intersecting gilling, open gilling with rub aprons, French or porcupine drawing. Short cut French systems are also studied using Pin Drafters and super draft porcupines, French Frame spinning, ring and mule twisting, winding. Mostly lectures, but modern laboratory equipment is available for demonstrations and running sample lots.

Tow to Top — Synthetic and Man-made Fiber M-207. This course covers in detail the processes and operations necessary to make top or sliver from synthetic or man-made tow. A detailed study is made of the Pacific Converter, Perlok system, Saco-Lowell Direct Spinner, etc. Mostly lectures, but sample lots are run on a Converter as time permits.

Top Mill Organization M-208. This course covers methods of calculating unit costs, personnel, work loads, cost of top, machinery layouts, supervisory help, production engineering. The over-all picture of an integrated woolen and worsted mill is considered to show how the top mill fits into the complete picture. The top mill is considered in detail. Lectures only.

Certificates

Certificates will be awarded for the following groups of courses:

Yarn Manufacturing by Woolen System — For completion of courses M-201, M-202, M-203A, M-203B, M-203C.

Wool and Staple Synthetic Top Manufacture — For completion of coursee M-201, M-202, M-204.

Worsted and Synthetic Yarn Manufacturing — For completion of courses M-201, M-202, M-204, M-205.

Wool and Staple Synthetic Yarn Manufacture on the French System — For completion of Courses M-201, M-202, M-204, M-206A, M-206B.

Diplomas

A diploma in woolen or worsted manufacture will be awarded to students completing the courses indicated below, or their equivalent. In order to fit the needs of the individual student, some variations and substitutions will be allowed, provided they are approved by the Head of the Department and the Evening Division Director.

A student desiring to work toward an Evening Division diploma should inform the Evening Division Registrar as soon as possible so that he may be properly advised as to what courses to take in order to complete his work in the minimum amount of time. Some of the courses listed below will not be given until needed by diploma students so it is important that candidates for diplomas keep in touch with the Registrar.

These courses will give the necessary background for the operation of a woolen or worsted mill and are designed for the student who wishes to prepare himself for the higher supervisory and executive positions.

The minimum requirement for the diploma in either woolen or worsted manufacture is a total of 720 classroom hours or an average of three evenings per week for four years.

For a diploma in woolen manufacture the following courses must be taken: Textile Mechanism and Calculations M-201, Technology of Natural and Man-made Fibers M-202, Yarn Manufacturing by Woolen System M-203A, Reprocessed and Reused Fiber Manufacture M-203B, Synthetic Yarn Manufacture on Woolen System M-203C, Elementary Textile Design M-351, Woolen Design M-329, Woolen and Worsted Design M-330, Power Weaving M-333, Woolen and Worsted Finishing M-710 and Textile Testing E-671.

The above courses total 570 classroom hours. The remaining 150 hours that are required may be elected by the student from the two groups of subjects listed after the requirements for the diploma in worsted manufacture. At least one subject must be elected from each group.

For a diploma in worsted manufacture, the following courses must be taken: Textile Mechanism and Calculations M-201, Technology of Natural and Man-made Fibers M-202, Wool and Staple Synthetic Top Manufacture M-204, Worsted and Synthetic Yarn Manufacturing M-205, Wool and Staple Synthetic French Combing M-206A, Wool and Staple Synthetic Yarn Manufacture on the French System M-206B, Elementary Textile Design M-351, Woolen Design M-329, Woolen and Worsted Design M-330, Power Weaving M-333, Woolen and Worsted Finishing M-710 and Textile Testing E-671.

The above courses total 630 classroom hours. The remaining 90 hours that are required may be elected by the student from the two groups of subjects listed below. At least one subject must be elected from each group.

Textile and Engineering Courses: Knitting M-115, Loom Fixing M-324, Quality Control E-646, Blue Print Reading E-638A, Tow to Top — Synthetic and Man-made Fibers M-207, Top Mill Organization M-208, Mechanism E-630 and other courses of a similar nature by approval of the Evening Division Director.

Business and General Courses: Foremanship G-653, Industrial Relations G-655, Industrial Psychology G-681, and other courses of a similar nature by approval of the Evening Division Director.

TEXTILE DESIGN AND WEAVING

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Assoc. Prof. Russell M. Fox
Assoc. Prof. Edward L. Golec
Assoc. Prof. John L. Merrill, B.T.E.
Asst. Prof. Martin J. Hoellrich
Mr. Robert F. Smith
Mrs. Lucy R. Weinbeck, B.T.E.
Mr. Albert T. Woidzik, B.S.

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Elementary Textile Design	M-351	Mon. & Wed.	None
Cotton Design	M-328	Tues. & Thurs.	M-327
Woolen & Worsted Design	M-330	Tues. & Thurs.	M-329
Power Weaving and Warp Preparation	M-332	Tues. & Thurs.	None
Power Weaving	M-333	Mon. & Wed.	None
Loom Fixing	M-324	Tues. & Thurs.	M-333

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Cotton & Synthetic Design	M-327	Mon. & Wed.	M-351
Woolen Design	M-329	Mon. & Wed.	M-351

Description of Above Courses

Elementary Textile Design M-351. This subject covers weaves of all types from the plain weave through fancy and figured weaves. Harness draft and chain are worked out for each weave. Yarn numbering for all systems, including ply and fancy yarns, are covered.

Cotton and Synthetic Design M-327. Cloth analysis and design are studied, beginning with plain fabrics and leading into stripes and plaids, plus the construction, yarn denier and filament count of various synthetic cloths.

Cotton Design M-328. The design and analysis of more elaborate cotton fabrics is taken up, such as extra warp and extra filling figured cloths, corduroys, velvets, ply fabric, Leno fabrics, etc.

Woolen Design M-329. Cloth analysis and design covering blanket, bath robing, filling reversibles, extra warp and filling backs, figured effects, double cloths, plaid backs, triple cloths and four ply fabrics.

Woolen and Worsted Design M-330. This subject includes the more complicated fabrics, some of which are chinchilla, melton, kersey, as well as suitings. Costs for woolen and worsted fabrics are also covered.

Power Weaving and Warp Preparation M-332. Warp preparation in all systems is covered as well as the Draper and Stafford automatic looms. Lecture and laboratory.

Power Weaving M-333. The more complicated looms are studied including dobby and Crompton and Knowles looms, as well as the Warner and Swasey Weaving machine. Weaving is primarily on woolen and worsted fabrics. Lectures and laboratory.

Loom Fixing M-324. The timing of all different motions in the loom and remedies for improper settings are covered. Box and harness chain planning and building are included. Lecture and laboratory.

Certificates

The Cotton Design certificate will be awarded for the successful completion of M-351, M-327 and M-328.

The Woolen and Worsted Design certificate will be awarded for the successful completion of M-351, M-329 and M-330.

Weaving certificates will be awarded for the successful completion of either M-332 or M-333.

The Loom Fixing certificate will be awarded for successful completion of M-324.

TEXTILE FINISHING

Staff

Assoc. Prof. Winford S. Nowell, B.M.E.
Assoc. Prof. John J. McDonald, B.T.C.

First Semester (*Oct.-Jan.*)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Woolen & Worsted Finishing	M-710	Mon. & Wed.	None

Second Semester (*Feb.-May*)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Cotton & Synthetic Finishing	M-718	Mon. & Wed.	None

Description of Above Courses

Woolen and Worsted Finishing M-710. The finishing of both woolen and worsted cloths. Some of the topics covered are burling, mending, fulling, washing, speck dyeing, carbonizing, gigging, napping, steaming, brushing, shearing and pressing. Lectures and some laboratory demonstration.

Cotton and Synthetic Finishing M-718. This course covers the methods of converting cotton and synthetic fabrics from the grey to finished state. All the processes and mechanisms of both wet and dry finishing are included. Modern resin finishes such as creaseproofing, water repelling, flame repelling, stabilization, etc., are included.

Certificates

A certificate will be awarded for the successful completion of either M-710 or M-718.

CHEMISTRY AND DYEING

Staff

Prof. Elmer E. Fickett, in charge of department
Assoc. Prof. William G. Chace, Ph.B., M.S.
Assoc. Prof. Ernest P. James, B.T.C., M.S.
Assoc. Prof. Allen Scattergood, A.B., Ph.D.
Asst. Prof. Charles L. Daley, B.T.C.
Asst. Prof. Charles A. Everett, B.T.C.
Asst. Prof. Charles L. Howarth, B.T.C.
Asst. Prof. Walter J. Lisien, B.T.C.
Mr. Herman Brown, B.S.
Mr. Vasilis Lavrakas, B.S., M.S.
Mr. Robert J. Peirent, B.S.
Mr. Ray E. MacAusland

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
General Chemistry	C-431	Mon., Tues. & Thurs.	None
General Chemistry	C-433	Mon., Tues. & Thurs.	C-432
Qualitative Analysis	C-435	Mon., Tues. & Thurs.	C-434
Quantitative Analysis	C-436	Mon., Tues. & Thurs.	C-435
Quantitative Analysis	C-441	Mon., Tues. & Thurs.	C-435
Organic Chemistry	C-438	Mon. & Thurs.	C-434
Textile Chemistry & Dyeing	C-423	Mon., Tues. & Thurs.	C-439
Textile Chemistry & Dyeing	C-425	Mon., Tues. & Thurs.	C-424
Physical Chemistry	C-421	Tues. & Thurs.	C-437

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
General Chemistry	C-432	Mon., Tues. & Thurs.	C-431
General Chemistry	C-434	Mon., Tues. & Thurs.	C-433
Quantitative Analysis	C-437	Mon., Tues. & Thurs.	C-436
Textile Quantitative Analysis	C-442	Mon., Tues. & Thurs.	C-441
Technology of Fibers	C-439	Tues. & Thurs.	C-438
Textile Chemistry & Dyeing	C-424	Mon., Tues. & Thurs.	C-423
Textile Chemistry & Dyeing	C-426	Mon., Tues. & Thurs.	C-425
Physical Chemistry	C-422	Tues. & Thurs.	C-421

Description of Above Courses

General Chemistry C-431 and C-432. This two semester course in basic Inorganic Chemistry is designed for those with no previous knowledge of Chemistry. It includes the fundamental laws of Chemistry; the preparation, properties and uses of metals, non-metals and related compounds; and simple chemical calculations. Two lectures 7–9 P.M. and one laboratory 6:30–9:30 P.M. per week.

General Chemistry C-433 and C-434. A two semester course in Inorganic Chemistry of college grade, open to those who have passed C-432 or a satisfactory course in high school Chemistry. Text — "General Chemistry" by Timin. Two lectures, 7–9 P.M. and one laboratory, 6:30–9:30 P.M. per week.

Qualitative Analysis C-435. A basic course in the systematic analysis of inorganic compounds, carried out by the student in the laboratory using semi-micro technique. Chemical calculations and the balancing of chemical equations are covered in the stoichiometry portion of the course. One lecture, 7–9 P.M. and two laboratories, 6:30–9:30 P.M. per week.

Quantitative Analysis C-436 and C-437. A two semester course of college grade covering the basic principles of gravimetric and volumetric analysis with sufficient laboratory work to enable the student to become proficient in performing routine analysis. One lecture, 7–9 P.M. and two laboratories, 6:30–9:30 P.M. per week.

Quantitative Analysis C-441. A one semester course in quantitative analysis for those not desiring college credit in Chemistry but who wish to develop laboratory skills and techniques of a practical nature. One lecture, 7–9 P.M. and two laboratories, 6:30–9:30 P.M.

Textile Quantitative Analysis C-442. This course is a continuation of C-441 and covers the analysis of materials used in textile mills, dye houses and finishing plants. Emphasis is placed on the practical techniques used in the analysis of bleaching agents, industrial water, soap, oils and synthetic detergents.

Organic Chemistry C-438. A study of the important classes of carbon compounds and the fundamental theories of Organic Chemistry. It provides the background in Organic Chemistry needed for those who wish to specialize in Textile Chemistry and Dyeing.

Technology of Fibers C-439. A basic course in the physical and chemical properties of natural and synthetic fibers, needed for those who wish to specialize in Textile Chemistry and Dyeing.

Textile Chemistry and Dyeing C-423, C-424, C-425, C-426. This course covers by lecture and laboratory the following topics: the action of chemical reagents on the natural and synthetic fibers, the preparation of fibers for dyeing, the application of all classes of dyes to cotton, wool, silk, synthetic and union materials and the testing techniques involved in measuring fastness to light, washing, crocking, perspiration, etc. One lecture, 7–9 P.M. and two laboratories, 7–9 P.M. per week.

Physical Chemistry C-421 and C-422. A basic course in Physical Chemistry designed for those in the laboratory or industry. It includes a discussion of properties of gases, liquids, solids, and solutions, chemical equilibrium, phase equilibrium, thermochemistry, electrochemistry, and other topics according to the need of the students. Laboratory work is included as required to give the student practice in the methods and apparatus of Physical Chemistry. Laboratory work includes the measurement of vapor pressure, viscosity, surface tension, heat of combustion and reaction, conductivity, determination of molecular weight, pH by various methods, etc. The first semester is largely lectures and the second is mostly laboratory.

Certificates

A two year General Chemistry certificate will be awarded for the successful completion of C-431, C-432, C-433 and C-434. The Physical Chemistry certificate will be awarded for the successful completion of C-421 and C-422. Certificates are also awarded for C-435, C-438, C-439, C-441 and C-442. The Quantitative Analysis certificate is awarded for successful completion of C-436 and C-437.

Diploma

The diploma in Textile Chemistry and Dyeing will be awarded for the successful completion of C-431, C-432, C-433, C-434, C-438, C-439, C-423, C-424, C-425 and C-426. This normally takes five years of three evenings per week.

Only high school graduates (or the equivalent) are eligible to enroll for diploma courses in Chemistry. The work covers the same ground and is held up to the same standard as the corresponding day school courses.

ENGINEERING AND ELECTRICITY

Staff

Prof. Herbert J. Ball, S.B., B.C.S., F.T.I., in charge of department
Assoc. Prof. Harry C. Brown, S.B.
Assoc. Prof. Maurice E. Gelinas, S.B., A.M.
Assoc. Prof. Henry E. Thomas, B.T.E.
Asst. Prof. J. Arthur Ainsworth, B.S., M.S.
Asst. Prof. James W. Bell
Asst. Prof. Horton Brown, B.S.
Asst. Prof. Andrew A. Ouellette, Sc.B.
Mr. Stanley T. Athas, B.S.
Mr. Louis C. Block, B.S., Ed.M.
Mr. A. E. Brownrigg
Mr. Albert L. Carpentier, B.S.
Mr. Frances L. Dacey
Mr. Robert K. Devejian, B.S.
Mr. Thomas F. Galvin
Mr. Walter Grondalski
Mr. Maurice W. Harrison
Mr. David K. Hines
Mr. Kenneth Hird
Mr. Stuart P. Jackson
Mr. Carl A. Johnson
Mr. Francis T. O'Hearn
Mr. Kenneth L. Rogers, B.S.
Mr. Edward N. Sabbagh, S.B.
Mr. Sydney E. Stirk
Mr. Chester Whitney

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Mathematics	E-620	Mon. & Wed.	None
Mathematics	E-621	Mon. & Wed.	E-620
Mechanical Drawing	E-613A	Mon. & Wed.	None
Mechanical Drawing	E-613B	Tues. & Thurs.	E-613A
Mechanical Drawing	E-613C	Tues. & Thurs.	E-613B
Mechanical Drawing	E-613D	Tues. & Thurs.	E-613C
Architectural Drawing	E-613E	Tues. & Thurs.	E-613B
Architectural Drawing	E-613F	Tues. & Thurs.	E-613E
Blue Print Reading	E-638	Mon. & Wed.	None
Machine Shop Practice	E-614	Wed. & Thurs.	None
Machine Shop Practice	E-615	Mon. & Tues.	E-614
Steam	E-622	Mon. & Wed.	None
Mechanism	E-630	Tues. & Thurs.	None
Calculus & Analytical Geometry	E-648	Tues. & Thurs.	Algebra & Trig.
Quality Control	E-646	Tues. & Thurs.	See description
Textile Testing	E-671	Tues. & Thurs.	None
Electrical Circuits	E-644	Mon. & Wed.	Algebra
A. C. Machinery	E-636B	Tues. & Thurs.	E-645
Fundamentals of Electronics	E-640	Tues. & Thurs.	E-645

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Mathematics	E-620	Mon. & Wed.	None
Mathematics	E-621	Mon. & Wed.	E-620
Physics	E-647	Tues. & Thurs.	None
Mechanical Drawing	E-613A	Mon. & Wed.	None
Mechanical Drawing	E-613B	Tues. & Thurs.	E-613A
Mechanical Drawing	E-613C	Tues. & Thurs.	E-613B
Mechanical Drawing	E-613D	Tues. & Thurs.	E-613C
Architectural Drawing	E-613E	Tues. & Thurs.	E-613B
Architectural Drawing	E-613F	Tues. & Thurs.	E-613E
Blue Print Reading	E-638A	Mon. & Wed.	None
Machine Shop Practice	E-614	Wed. & Thurs.	None
Machine Shop Practice	E-615	Mon. & Tues.	E-614
Strength of Materials	E-621	Mon. & Wed.	None
Diesels	E-632	Mon. & Wed.	None
Air Conditioning	E-634	Mon. & Wed.	None
Textile Testing	E-671	Mon. & Wed.	None
Calculus & Analytical Geometry	E-649	Tues. & Thurs.	E-648
Electrical Circuits	E-645	Mon. & Wed.	E-644
D. C. Machinery	E-636A	Mon. & Wed.	E-645
Industrial Electronics	E-641	Tues. & Thurs.	E-640
Principles of Radio	E-642	Mon. & Wed.	E-640

Description of Above Courses

Mathematics E-620. Algebra, including addition, multiplication, subtraction, division, factoring and fractions.

Mathematics E-621. A continuation of E-620. Some of the topics treated are graphical representation, linear equations, radicals, quadratic equations, logarithms, slide rule, and some trigometry.

Physics E-647. An elementary course in physics on the high school level, designed primarily for those lacking sufficient high school credits to work toward a diploma. Lecture and demonstration.

Mechanical Drawing E-613A, B, C, D. This four semester course covers the fundamentals of engineering drawing. The first semester covers lettering, use of instruments, geometric construction, orthographic projection, multi-view and pictorial free hand drawing. The second semester includes dimensioning, auxiliary views, cross sectioning, screw threads and working drawings. The third semester covers intersections, pictorial drawings and applications to sheet metal drawings. The fourth semester covers assembly drawings from details of parts and detailing from designers assembly drawings.

Architectural Drawing E-613 E, F. The first semester covers problems of detailing and alteration such as a young draftsman might encounter in an architect's office. The second semester includes design of a small house including floor plan, elevations, sections, details, heating, plumbing and electrical drawings as well as cost estimates.

Blue Print Reading E-638. A short course for those who wish to understand the principles of mechanical drawing such as projections, sections, dimensioning, etc., in order to read and understand blue prints.

Blue Print Reading E-638A. A short course similar to E-638 except that the emphasis is on architectural blue prints rather than engineering blue prints.

Machine Shop Practice E-614, E-615. A two-semester course in metal working, including bench work, lathes, grinders, planers, shapers, presses, milling machines, care of tools, tool grinding, heat treatment, forging, use of special tools, etc.

Strength of Materials E-621. A basic course in strength of materials covering such topics as tension, compression, shear, cast iron, wrought iron, steel, timber, design of bolts, tie rods, columns, boiler shells, riveted joints, etc., beam theory, torsional stresses, shafts, etc.

Steam E-622. Heat generation, transmission, and utilization. Topics covered are heat and its measurement, use of steam tables, types of boilers, engines and turbines, boiler and engine room accessories, testing, etc. Lectures and assignments.

Mechanism E-630. A study of the principles used in the transmission of force and motion through machines and mechanical devices. Topics covered are mechanics, accelerated motion, moments of force, pulleys, belting, gears, cams, etc.

Diesel Engines E-632. An elementary study of diesel engines, their operation, and maintenance. Topics covered include types of diesels, fuel oils, fuel injection systems, combustion, cooling systems, application, maintenance, etc. Lectures and assignments.

Air Conditioning E-634. A course in the principles of air conditioning covering the fundamental laws, physical properties of the atmosphere, measuring instruments, heating, cooling, humidification and dehumidification systems, air filtration, refrigeration, etc. Lectures and assignments.

Textile Testing E-671. A study of the methods used in the determination of the physical properties of textiles and the interpretation of test data. The topics covered include a consideration of textile fibers and their properties, testing machines, breaking strength, elongation, fabric structure, tearing strength, thickness, bursting strength, crimp, twist, regain, etc. Lectures and laboratory.

Quality Control E-646. This course deals with the quality problem in manufacturing and approaches it through the use of statistical quality control. How to determine the true accuracy of a machine or process, how to distinguish between normal and abnormal variations in any process and how to use small sample plans for inspection are examples of topics covered. Prerequisite: Approval of the instructor. Normally requires two years of college or industrial experience. Statistics is not required. Limit to 25.

Calculus E-648, E-649. The fundamental principles of differential and integral calculus. The first semester covers differential calculus with the necessary analytical geometry and the second half covers integral calculus. This course is a college credit course and is accepted for credit toward the B.S. degree of Lowell Technological Institute. Only students with a good background and ability in mathematics should attempt this course.

Electrical Circuits E-644, E-645. A two-semester basic course in direct and alternating circuits. Topics include: Ohm's Law, series and parallel resistance, power, magnetic fields, inductance, capacitance, impedance, etc. Lecture and laboratory.

D. C. Machinery E-636A. The theory and operation of generators, motors, power plant switchboards, etc. Industrial application of D. C. machinery, parallel operation, etc. Laboratory work covers methods of operating and testing D. C. equipment.

A. C. Machinery E-636B. Topics include application of instruments to A. C. circuits, alternators, transformers, power plant switchboards, induction motors, synchronous motors, single phase, polyphase (delta and three phase, four wire systems), etc. Laboratory work covers operation and testing of equipment.

The Fundamentals of Electronics E-640. Topics include vacuum tube theory, vacuum tube applications including rectifiers, power supplies, amplifiers, classes of amplifiers, voltage gain and power amplifiers, electronic instruments, etc. Lecture and laboratory.

Industrial Electronics E-641. The theory and operating characteristics of gas and vacuum tubes, photo-electric cells, and the thyratron. Topics covered include amplifiers, electronic relays and timers, thyratron applications, phase shifts, inverters, rectifiers, motor and welder control, textile and other applications. Lecture and laboratory.

Principles of Radio E-642. Audio systems, microphones, loud speakers, radio wave propagation, antennas, transmission lines, amplitude and frequency modulation, radio transmitters, modulators, detectors, receivers, tracking and alignment, servicing instruments, etc. Lecture and laboratory.

Certificates

Certificates are awarded for the successful completion of the following courses or groups of courses: E-620 and E-621; E-613A, E-613B, E-613C and E-613D; E-613A, E-613B, E-613E and E-613F; E-614 and E-615; E-638; E-638A; E-622; E-630; E-648; E-649; E-646; E-671; E-644 and E-645; E-647; E-636B; E-636A; E-640; E-641; E-642; E-621; E-632; and E-634.

ART

Staff

Prof. Vittoria Rosatto, B.S., in charge of department
Mr. George E. Bowring
Mrs. William G. Chace
Miss Margaret Donohoe
Mr. Edward W. Dooley
Mrs. William E. Kaknes
Mrs. William R. Kiernan
Mrs. Margaret A. Moriarty
Miss Antoinette W. Nault
Miss Arlene C. Redmond
Mr. John F. Vaughan

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Freehand Drawing	G-313	Mon. & Wed.	None
Freehand Drawing	G-313	Tues. & Thurs.	None
Silk Screen Printing	G-326	Tues. & Thurs.	None
Show Card Design	G-314	Mon. & Wed.	None
Costume Design	G-335	Tues. & Thurs.	None

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Pastel Drawing	G-334	Mon. & Wed.	G-313
Life Drawing	G-340	Mon. & Wed.	G-313
Show Card Design	G-315	Mon. & Wed.	G-314
Costume Design	G-336	Mon. & Wed.	G-335
Fashion Illustration	G-342	Tues. & Thurs.	G-313

Description of Above Courses

Freehand Drawing G-313. Drawing in charcoal from casts and group arrangements of still life. Both sections cover the same material.

Pastel Drawing G-334. Drawing in pastel from still life group arrangements.

Life Drawing G-340. Drawing from the live model in charcoal or in pastel. Individual and class instruction in anatomy.

Silk Screen Printing G-326. This course covers the stencilling and printing on textiles and paper with the silk screen.

Show Card Design G-314 and G-315. A two-semester course in the preparation of commercial signs. The first semester deals largely with lettering and elementary layouts. The second semester teaches more elaborate layouts and designs executed in tempera paints.

Costume Design G-335 and G-336. This course deals with methods of altering a commercial garment pattern to suit the requirements of any figure. The second semester deals with the drafting of original patterns.

Fashion Illustration G-342. This course provides training in fashion illustration as applied to promotion and advertising display.

Certificates

A certificate will be awarded for the successful completion of any of the above courses.

ENGLISH

Staff

Prof. Lester H. Cushing, A.B., Ed.M., in charge of department
Assoc. Prof. James G. Dow, A.B.
Asst. Prof. Louis W. Stearns, B.S., M.A.
Miss Margaret Delaney, B.S., Ed.M.

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
English Composition	G-520	Mon.	None
Vocabulary Building	G-515	Tues. & Thurs.	None
Appreciation of Literature	G-512	Tues.	None

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
English Composition	G-521	Tues.	G-520
Appreciation of Literature	G-512	Tues.	None

Description of Above Courses

English Composition G-520. The fundamentals of composition including remedia English, grammar and rhetoric.

English Composition G-521. A course in how to write clearly and correctly. Ar intensive study is made of narration, description, exposition, argumentation anc the art of letter writing.

Appreciation of Literature G-512. A course for those wishing to enlarge thei cultural background and study the principles of literary appreciation and criticism Prose and poetry will be treated analytically with directed investigation of th various literary appeals — the intellectual, the sensory, the emotional, the aesthetic the imaginative and the philosophical.

Vocabulary Building G-515. This course is designed to aid the student in enlarg ing his vocabulary and improve his understanding and choice of words. Languag roots and word evolution are also considered.

Certificates

A certificate will be awarded for the successful completion of G-515; G-512; an G-520 and G-521.

BUSINESS AND GENERAL

Staff

Prof. Charles F. Edlund, S.B., Ed.M., in charge of department
Prof. Herman H. Brase, A.B., M.A.
Mr. Joseph P. Conlin, A.B.
Miss Clare T. Garrity
Mr. George C. Hedrick
Mr. Richard W. Ivers, B.A., Ed.M.
Mr. Thomas A. Malloy, A.B., M.A.
Dr. Paul V. McLaughlin, Ph.B., Ph.L., Ph.D.
Mr. Xenophon D. Michopoulos, A.B., M.A.
Mr. Milton Richards
Mr. Anthony Valkevitch

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Foremanship	G-653	Mon. & Wed.	None
Industrial Relations	G-655	Tues. & Thurs.	None
Principles of Salesmanship	G-656	Tues. & Thurs.	None
Industrial Psychology	G-681	Tues. & Thurs.	None
Business Law	G-678	Tues. & Thurs.	None
Principles of Advertising	G-657	Tues. & Thurs.	None
Accounting I	G-682	Tues. & Thurs.	None
Politics and the Tax-payers	G-686	Mon. & Wed.	None
Contemporary World Problems	G-658	Mon. & Wed.	None

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Foremanship	G-653	Mon. & Wed.	None
Principles of Salesmanship	G-656	Mon. & Wed.	None
Accounting II	G-683	Tues. & Thurs.	G-682
Psychology	G-675	Tues. & Thurs.	None
The Political & Social Crisis of the 20th Century	G-687	Mon. & Wed.	None

Description of Above Courses

Foremanship G-653. A course in foremanship principles and problems based on the Foremanship Management Conference Manuals of the National Foreman's Institute. It is designed to help men now acting as foremen in a more successful handling of their job and is conducted by the conference or seminar method, each man bringing in his own problems for analysis by the group. Some of the topics include understanding people, the foreman as a leader, eliminating irritations, training workers on the job, getting along with the man above, eliminating waste, wage incentives, cost factors the foreman can control, etc.

Industrial Relations G-655. A basic course in the underlying principles of harmonious relations between employer and employee. Some of the topics covered include: company policies and the foreman, employee morale, grievances, wages, training, collective bargaining, unions, government regulations, arbitration, etc.

Principles of Salesmanship G-656. The fundamentals of salesmanship including the psychology of selling, building a selling talk, showmanship, elements of successful selling, wholesale and retail salesmanship, etc. Lectures plus student participation.

Principles of Advertising G-657. The fundamentals of advertising including psychology, copy writing, layout, production, testing, campaigns, etc. Lectures and assignments.

Contemporary World Problems G-658. A course on the present day issues of the world, viz: communism, nationalism, imperialism, socialism, secularism; etc., as they pertain to the individual's intellectual, physical and emotional life in society.

Psychology G-675. This course covers the fundamentals of psychology with particular reference to the group relationships of the individual.

Business Law G-678. This course covers the basic legal principles of use to people in the conduct of their every day affairs. Topics covered include contracts, mortgages, deeds, negotiable instruments, easements, conditional sales, partnerships and corporations.

Industrial Psychology G-681. This is a course in the application of basic psychological principles to the problems of industry. Among the topics touched upon are: training, grievances, conferences, leadership, communications, etc.

Accounting I and Accounting II G-682, G-683. A basic course in the principles of accounting. The first semester deals with the preparation and interpretation of reports and statements of financial position. The balance sheet, profit and loss statement, theory of debits and credits, ledger, etc., will be covered. The second semester will carry the student into payroll and tax accounting, partnership and corporate records and the basic principles of cost accounting.

Politics and Taxpayers G-686. This course is for the every-day citizen, to help him understand and participate in the process of governing and being governed. Problems submitted by the class will be discussed with emphasis on local and state government. Field trips to view local governing bodies will be part of the course.

The Political & Social Crisis of the 20th Century G-687. This course covers the specific problems of recent history and their impact on the present. It is essentially a course in current events with an evaluation of their roots and background.

Certificates

A certificate will be awarded for the successful completion of any of the above courses.

PAPER ENGINEERING

Staff

Prof. John Lewis, B.S., M.S., in charge of department
Mr. Alfred K. Hobbs, B.S., M.S.

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Pulp and Paper Technology	E-801	Tues.	None
Pulp and Paper Testing Laboratory	E-803	Wed.	E-801 concurrently

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Advanced Paper Technology	E-802	Tues.	E-801

Description of Above Courses

Pulp and Paper Technology E-801. This course covers the basic principles of the manufacture of the commonly used papermaking pulps. This is followed by a study of stock preparation and paper machine operation.

Advanced Paper Technology E-802. This course covers the details of the manufacture of various papers and their conversion to a useful end product. Guest lecturers will supplement the regular staff.

Pulp and Paper Testing Laboratory E-803. A laboratory course in the physical and chemical testing of pulps and papers.

Certificates

A certificate will be awarded for the successful completion of E-801 and E-802.

LEATHER ENGINEERING

Staff

Prof. Albert E. Chouinard, B.S., M.S., Ph.D., in charge of department
Mr. Alfred H. Mueller
Mr. Louis Strymish, A.B., Ed.M.

First Semester (Oct.-Jan.)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Leather Finishing	E-918	Mon. & Wed.	None

Second Semester (Feb.-May)

SUBJECT	NUMBER	EVENINGS	PREREQUISITE
Leather Finishing	E-919	Mon. & Wed.	E-918

Description of Above Courses

Leather Finishing E-918, E-919. A two-semester course in the study of the various operations performed on rough tanned leather, with particular emphasis of the operations of fat liquoring, drying, coloring and coating. This course is designed for the practical man who is either a user or processor of leather.

Certificates

A certificate will be awarded for the successful completion of E-918 and E-919.

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ELECTRON MICROSCOPY
AN INTRODUCTORY SURVEY

by

Edward N. Sabbagh*

Introduction

The rapid advance of electron microscopy since its beginning about two decades ago has increased our range of direct vision in such a manner that the electron microscope has become an important tool of research. The purpose of this paper is to survey the more salient features of this instrument and to indicate the present fields of application with emphasis on textile fibers.

Theory

The image of a point source formed by a lens is given by diffraction theory (pertaining to those effects produced by the passage of light through restricted apertures) to be a disk of light of finite size. The ultimate resolution or resolving power of an optical system is that smallest distance between two points which can be separated or distinguished as two in the image. If the points are closer than this distance, their images merge until they are no longer separable, notwithstanding the magnification. This resolving power is determined by the wavelength of the illumination used by the system. There are other factors concerned, such as the angle subtended by the lens at the object and the illuminating conditions; however, in any one system, the smaller the wavelength, the closer the resolved points may be. One may visualize this by considering the effect of a particle on an incident wave. The smaller the wave relative to the particle, the greater will be the disturbance on the wave. Furthermore, a particle much smaller than the wave will have no appreciable effect on the wave, and hence its presence will not be detected. The ultimate resolution may be taken to be one-half the wavelength of the light used by the system, although the practical resolution is somewhat less than this. Accordingly, one cannot hope to see fine detail of size less than about 0.25 μ with visible light of wavelength 0.50 μ.**

These implications were the result of the Wave Theory of Light set forth in the Nineteenth Century. At the close of this period, it was observed that electrons in a cathode ray tube were deflected by either an electrostatic or electromagnetic field. The full significance of this deflection was not realized until the further development of the theory of light and of an experimental consequence therefrom.

The concept of an electron as a particle is only partially correct; its dual nature offers another aspect, the wave mechanical electron, which consists of a wave packet giving an energy concentration in space. De Broglie showed that a wave motion is associated with accelerated electrons and that the wavelength is inversely proportional to the velocity and mass of the electron. And finally, Busch (1926) showed that an electromagnetic coil could form a faithful image with respect to an electron beam in much the same manner as an optical lens with respect to light. Ruska in Berlin published the first account of a magnetic electron microscope in 1932; other workers soon followed. Since then, firms in this country and abroad have come forth with progressively better microscopes so that now the electron microscope is firmly established as a tool of research with a resolution approximately one hundredth that of the light microscope.

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* Assistant Professor in the Department of Textile Engineering, Lowell Technological Institute of Massachusetts.

** $1\ \mu = 1$ micron $= 10^{-3}$ mm.

Figure 1 shows the analogy between the optical microscope and the magnetic electron microscope. Actually, electron rays do not travel in straight lines as shown, but instead follow a helical path due to the normal force of deflection produced by the magnetic field. In both microscopes, the rays of light or electrons are emitted from a source and focused by the condenser into an almost parallel beam before entering the specimen. The final image is formed by two stages of magnification, the objective and projector systems.

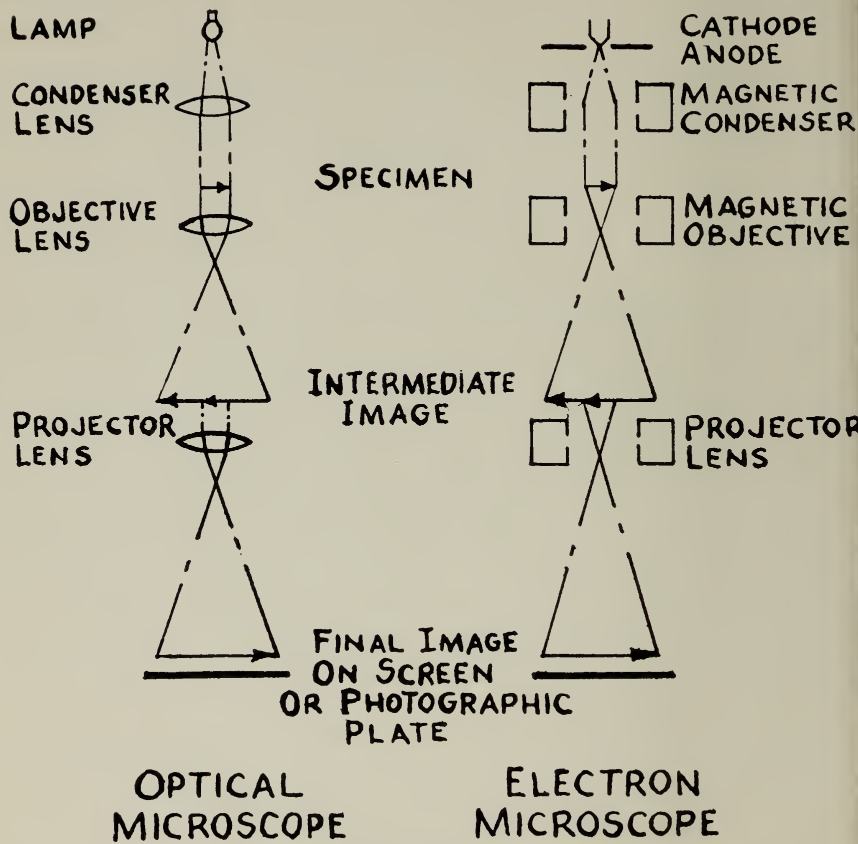

Figure 1. Comparison of the optical and electron microscopes.

The electron microscope column is enclosed and under a vacuum of 10^{-5} mm. o mercury. This vacuum is obtained by means of an oil diffusion pump backed by mechanical pump. High voltage and low voltage electronic circuits supply th electrical requirements. The hot cathode is at a negative potential of about 50,00 volts in most microscopes, but this figure varies. In the electrostatic type of electro microscope, the magnetic lens is replaced with an electrostatic lens. There are nov several types of electron microscopes available from different manufacturers wit the magnetic type most prevalent.

Electrons accelerated under 50 kv. have a wavelength of about 0.05 Å.* Howeve lens aberrations restrict the ultimate resolution available to about 20 to 30 Å. Unde most conditions, the resolution is about 50 to 100 Å.

* 1 Å = 1 Ångström = 10^{-7} mm.

The magnification available is closely related to the practical resolution. The human eye has a resolution of about 0.2 mm. Although this figures varies with different observers, it means that two points 0.2 mm. apart on an object placed 25 cm. from the eye will just be seen as two. If an optical enlarging system is placed between the object and observer, the image can be magnified so that the eye can observe the still finer detail present. However, if a magnification more than is necessary is used, the blurred images of unresolved particles will simply be enlarged and no additional detail will be seen. This is referred to as "empty" magnification. Because of the fine structure of the photographic emulsions used to prepare electron micrographs, photographic enlargements can be used to prepare the final image. Consequently, an electron microscope supplying a maximum magnification of 30,000 X can be made by photographic means to furnish a useful magnification of over 100,000 X.

Another advantage of the electron microscope is its high depth of field. Since the high degree of lens aberrations restricts the useful aperture of the objective lens, the depth of field is correspondingly increased to several microns as compared to a fraction of a micron for the optical microscope. As a result of this characteristic, the electron microscope has been adapted for taking three dimensional photographs.

INTERACTION OF ELECTRONS WITH MATTER

Electrons are readily absorbed by matter to an extent dependent upon the accelerating potential. Fifty kilovolt electrons will be absorbed by thicknesses of more than 0.2 u. This fact imposes severe limitations upon the preparation of specimens. First, the lens system and specimen must be placed in a high vacuum. Specimens must be thin and desiccated. Artifacts may be introduced resulting from the electronic bombardment. These factors are to be borne in mind when preparing specimens and are the chief limitations of electron microscopy.

In an optical microscope, an object is visible because of differential absorption, refraction, and reflection over various parts of the specimen. In the electron microscope, an object is primarily visible because of the phenomenon of scattering. Collisions (both elastic and inelastic) between the electrons and particles of the specimen produce a change in the original direction of the electrons by an amount depending upon the density, atomic number, and thickness of the specimen; the scattered electrons are lost. Different points scatter differently, and this differential scattering produces electron intensity variations over the image. Consequently, there is no color associated with specimens in the electron microscope as there is in objects viewed by visible light in the range 0.4 to 0.7 microns.

SPECIMEN PREPARATION

Techniques used in electron microscopy are by necessity long and involved. It is intended here to acquaint the reader with some of the more basic procedures in order that he might better understand and interpret micrographs presented in the literature.

The limitations described above have, in part, been counteracted by developments in laboratory technique which have enabled a wide range of objects to be studied. One may classify the types of materials applicable for study into three broad categories, as follows:

(1) Particle studies and submicroscopic objects, such as smokes, dusts, pigments, fibrils, bacteria, viruses, and macromolecules.

(2) Thin films of plastics, rubber, evaporated metals, and silica.

(3) Thin sections of objects themselves too thick for direct study such as organic materials which can be cut by an ultra-microtome.

(4) Replicas or casts of surface structures of both inorganic and organic materials in which the replicating material may be a plastic, silica, or thin layers of evaporated metals.

For details the reader should refer to the literature for specific types of material study. However, a brief account follows. Analagous to the 1″ by 3″ glass slides used in optical microscopy, ⅛″ diameter disks of 200 mesh wire screens (or grids) are used to support the specimen. In the simplest type of specimen preparation, as in the study of smokes, one may merely place the wire screens in the smoke — the particles cling to the wire mesh — and the grid is then placed in the specimen holder for observation in the microscope. To support particular matter, such as pigments, one provides a transparent membrane or supporting substrate of thickness in the vicinity of 0.01 μ. This substrate might be composed of such materials as collodion, Formvar, ethyl cellulose, polystyrene, or evaporated silica. To make this film, one may use a variety of methods. The simplest substrate is cast from water. A drop of a solution of 2% collodion in amyl acetate is placed on the surface of clean, distilled water. Because of surface tension effects, the drop spreads rapidly over the surface and the solvent evaporates leaving a thin film which can be transferred to the metal grid. The specimen can then be placed on this film either by direct application, by dry dusting, by evaporation from a suspension, or by thermal or electrostatic precipitation.

Substrates which cannot be cast on water (polystyrene dissolved in benzene) may be made by applying a dilute solution to a glass microscope slide, drying, and then immersing in water. The water works its way under the film and loosens it to let the film float to the surface.

Silica, silicon monoxide, and thin metallic films may be formed by evaporation under vacuum onto a plastic mounted on a grid — the plastic being subsequently dissolved away.

Gross metallic surfaces may be studied by replication, that is, a cast or replica is made of the surface by the use of a plastic, silicon monoxide, or evaporated metal.

Textile fibers are too thick for penetration as such by the electron beam but they may be studied by the following methods:

(1) Surface studies: Replicas are made of the fibers by sandwiching them under light pressure between two glass slides, one of which is coated with a thin layer of a thermoplastic lacquer evaporated from a dilute solution. Polystyrene and ethyl cellulose have been used with success (11). After placing the clamped slides in a heat oven at a temperature above the fusion point of the plastic, the fibers are removed, the plastic replica is stripped in water and mounted on a grid.

(2) Degradation products or fibril studies: The fibers are beat in an aqueous suspension in a Waring Blendor until the fibers disintegrate along lines of natural weakness into fibrils. These are mounted as particles on a supporting substrate; the breakdown may also be accomplished by an enzyme.

(3) Thin sections of the fibers may be made by a specially modified microtome; the sections must be about 0.1 μ thick.

METALLIC SHADOW CASTING

Since specimens of organic origin are composed of chemical elements which because of their comparatively low atomic numbers do not scatter the electron beam appreciably, the resultant contrast in the images of fiber replicas is low. The contrast may be increased by metallic shadow casting. As an analogy to this process, one should consider an opaque material viewed with visible light under an oblique illumination. The elevations in the specimen will be accentuated in relief compared to the depressions which receive less of the illumination. Figure 2 is a schematic diagram of a vacuum coating apparatus for metallic shadow casting. Fragments of a suitable metal (chromium, gold, palladium, platinum) are placed in a spirally wound 20 mil tungsten wire filament which is electrically heated under a high vacuum. The specimen is placed a few centimeters away and below the filament depending on the length of "shadows" desired. The metal evaporates at that temperature of the filament at which the vapor pressure of the metal exceeds the vacuum, and the molecular rays of the evaporated metal travel in straight lines

until they impinge upon an obstacle. Elevations in the specimen facing these rays receive an excess of the metal and the leeward sides of the elevations receive a deficiency, producing a shadow in reverse. Portions with an excess of metal scatter the electron beam more than do other regions and when the specimen is viewed in the microscope, these regions appear darker. Since the image on the screen of the microscope is recorded photographically, the negative will show the shadows as such and heavily deposited areas will appear as highlights. The final print can be either a positive or a negative one by a suitable photographic reversal. Besides bringing out the detail, a three dimensional effect is produced. This technique is best suited for surface studies and not for studies of internal structure. Silica films used as supporting substrates or as positive replicas can also be formed using this apparatus when the specimen is placed so that the rays impinge vertically rather than at an angle.

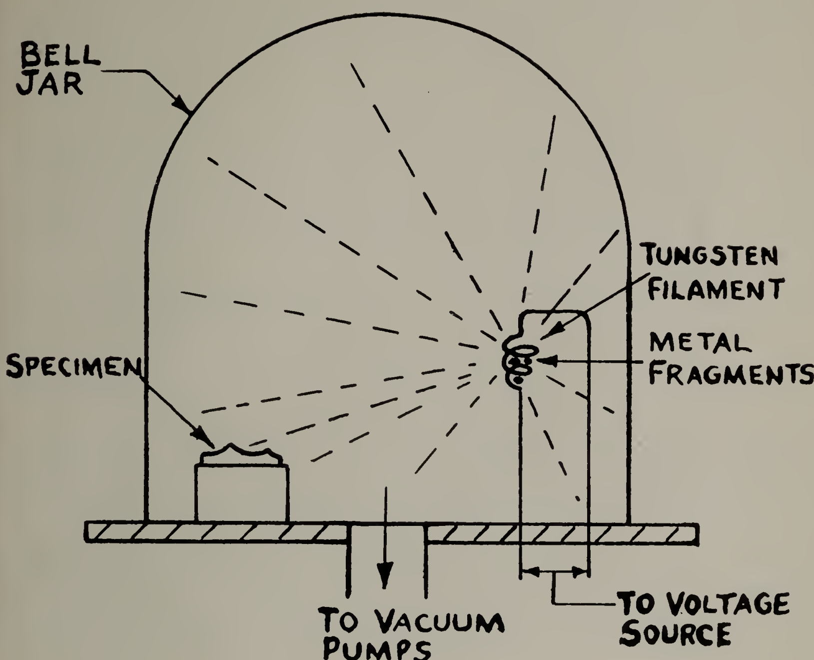

Figure 2. Diagram of metallic shadow casting.

APPLICATIONS

At present the electron microscope is designed for viewing fine detail and structure below the resolving power of the optical microscope and down to about 100 A. In this general application it has been very successful; a wealth of materials has been investigated even in the short time that has elapsed since the first electron microscope. Possible applications are unpredictable, and furthermore, instrument design is continually being improved. It would be pertinent to take note of some of the present limitations. Specimens must be thin and desiccated; specimen preparation and study are more involved and time-consuming than in optical microscopy. Both initial cost and cost of maintenance are higher. Perhaps it would not be proper to make a comparison. It is intended that the electron microscope not supplant the optical microscope but instead, supplement it.

Concerning specific application, one can only go by the literature; undoubtedly, not all the work done is published. In the field of textiles, the electron microscope

has been used to study the fine structure of fibers with an attempt to correlate the effects of physical, chemical, and mechanical agents with observable changes on the fiber components; of course, these applications must be preceded by the study of the morphological characteristics of undamaged fibers and much of this has already been accomplished.

The wool fiber has received special consideration both in this country and abroad. The effect of various non-felting treatments on the surface structure of the fiber has been investigated (8). Since the dye absorption of wool is determined, in part, by the properties of the various components of the fiber, the electron microscope offers greater insight into the problem of the relation between dyes and specific portions of the fiber. Cross sections of the wool fiber cuticle have also yielded information on the histology of this component of the fiber (9).

Scales of undamaged wool are relatively smooth but do show some longitudinal striations. Certain treatments, such as the alcoholic anti-felting process, wet-chlorination, and light mechanical abrasion, remove the less resistant, smooth layer revealing a prominent longitudinal structure (10). More drastic action is realized in chlorzymed wool, where the scales are removed exposing the cortical cells. The shadowed replica method has again been used in extensive studies on the role of the cuticle with respect to chemical and mechanical degradation (11). Electron micrographs reveal that the lacquer-like coating on the wool scales is removed by mechanical abrasion, exposing a rigid striated structure consisting of regular corrugations running more or less parallel to the fiber axis. Further abrasion leaves a smooth filamentary structure and more rubbing removes the next amorphous layer exposing the cortical cells.

The internal structure of the wool fiber has also been studied by means of agents which ultimately disintegrate the fiber into fibrils (12) (13) (14). This may be accomplished mechanically by beating the fibers in a Waring Blendor; or, chemically, by an acid or by the enzyme, trypsin. The cortical cells (which are also visible in the optical microscope) break down into microfibrils, long and tapering, with a diameter of the order of magnitude of 200 A.

Studies of dyed nylon by means of silica replicas have shown how steaming increases the size of dye particles (15). The actual dye particles are retained in the replicas. The method, with modifications, might be applicable to other fibers, but no account of such work has been found in the literature by the author.

Cellulosic fibers, both natural and regenerated, have been studied rather extensively. Materials of cellulosic origin consist of elementary filaments, or fibrils, a few hundred Ångströms in diameter; thus cellulose from the fibers of wood, cotton, hemp, and flax may be split by chemical or mechanical means to yield elementary fibrils (as well as various amounts of other substances associated with them). Fine fibrils, whose diameter vary from about 90 to 400 A have been demonstrated in beaten natural cellulose fibers (16). Large fibrils as observed in the light microscope are composed of bundles of these finer units. Differences in the fibrils suggest a correlation between the character of the fibrils and the physical and chemical properties of the fibers.

In a study of cuprammonium rayon, regular textile viscose rayon, and high-tenacity viscose rayon, fibril-like structures with diameters of a few hundred Ångströms were obtained from fibers beaten in a Waring Blendor (17). Variations in distinctness of fibrillation occurred with respect to fiber type and with respect to different portions of the fiber, the outside portions of the fiber showing a high degree of orientation. Although fibrils from these regenerated celluloses were less uniform than those from the natural celluloses, the two were in many respects similar. Surface replicas of these fibers showed that cuprammonium fibers were relatively smooth as compared to regular textile viscose rayon fibers. These methods could be used to study the effects of various processing phases upon observed differences in fiber structure.

The lateral strength of cellulose acetate has been studied by random disintegration of the fiber and subsequent electron microscopic analysis to determine the lines

of natural weakness as evinced by the extent of fibrillation (18). The unoriented saponified cellulose acetate broke down into irregularly shaped particles typical of amorphous materials. The oriented cellulose acetate yarn, however, disintegrated into long filamentary particles indicating a loss in lateral strength.

In a work where natural cellulose fibers and Fortisan were degraded by an acid treatment, there were found uniformity in the lateral sizes of the fibrils and an apparent correlation between the particle size and the crystallinity of the fibers as determined by X-ray studies (19).

More recently, further work was done on the products of wet disintegration of textile fibers in a Waring Blendor (20). The natural cellulose fibers of cotton, ramie, and linen showed fibrils of one or two hundred Ångströms in diameter. Similar fibrils were found in the man-made cellulose fibers, especially in the highly oriented Fortisan and Durafil. The fibrils in cuprammonium rayon were not as clear-cut as in the latter two; X-ray diffraction pictures, however, showed almost as good an orientation. The need for further investigation regarding the relationship of degree of orientation and extent of fibrillation is indicated.

OTHER FIELDS

Applications in other fields are so numerous, and the literature so extensive that it is not within the scope of this paper to survey them. One can only point to the journals of the particular field of interest and to the bibliography. Much work has been done in biology and metallography, where the electron microscope has become an indispensable tool of research. Some of the other applications occur in the fields of air pollution studies, carbon black size distribution studies, catalysts, ceramics, clays, dusts, dyes, greases, paints, paper, photographic emulsions, pigments, polymers, synthetic rubber latex, smokes, and soils.

ILLUSTRATIONS

A number of electron micrographs taken by the author at the Lowell Technological Institute with a RCA EMC console type electron microscope are presented by way of illustration. This instrument was designed primarily for factory process control with certain simplifications in design. Magnification (electronic) is fixed at either 500 X or 5,000 X, approximately; the anode potential is at 30 kv.

Figure 3 shows a larger particle with several smaller ones of the mineral, kaolin. The particles are composed of hexagonal sheets often stacked together. This preparation was unshadowed; the holes in the collodion substrate are not always as numerous as here shown. In this micrograph, as well as in the others, the magnification given is the combination of electronic and photographic enlargements.

Figure 3. Kaolin particles. Collodion substrate. —12,500 X.

The increased contrast afforded by metallic shadowing is exemplified in Figure 4. The cubical particles of magnesium oxide smoke formed from burning magnesium were collected on a membrane of collodion and then shadowed with chromium. From a knowledge of the shadowing angle and the length of a shadow, one can determine the height of a particle as well as additional information about its shape.

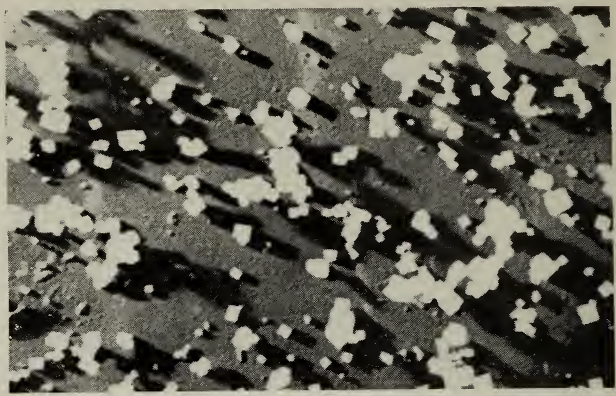

Figure 4. Magnesium oxide smoke. Chromium shadowed. — 16,000 X.

The cellulose fibrils in Figure 5 were obtained by the mechanical beating of an aqueous suspension of cotton fibers for about 25 minutes in a Waring Blendor.

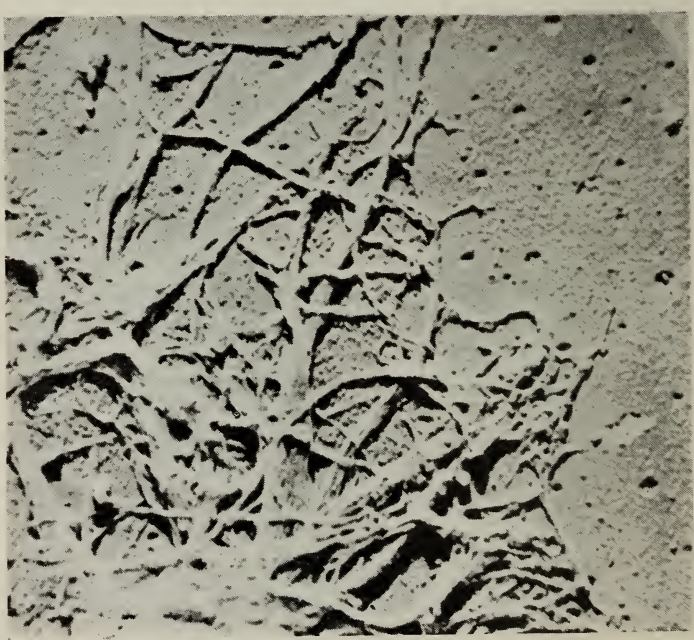

Figure 5. Cellulose fibrils from cotton.
Collodion substrate. Chromium shadowed. — 17,000 X.

Figure 6 is a polystyrene replica of a wool fiber. The scales stand out in relief as a result of the shadowing process. This micrograph is an example of how artifacts which may be introduced in the preparation of the specimen should be distinguished from the actual surface structure of the fiber. The wrinkles which extend out beyond the replica are not an actual part of the original fiber.

The presence of foreign particles, although not always desirable, is useful in determining what the direction of shadowing is and whether the replica is a positive or negative one. This information distinguishes the elevations from the depressions in the original specimen.

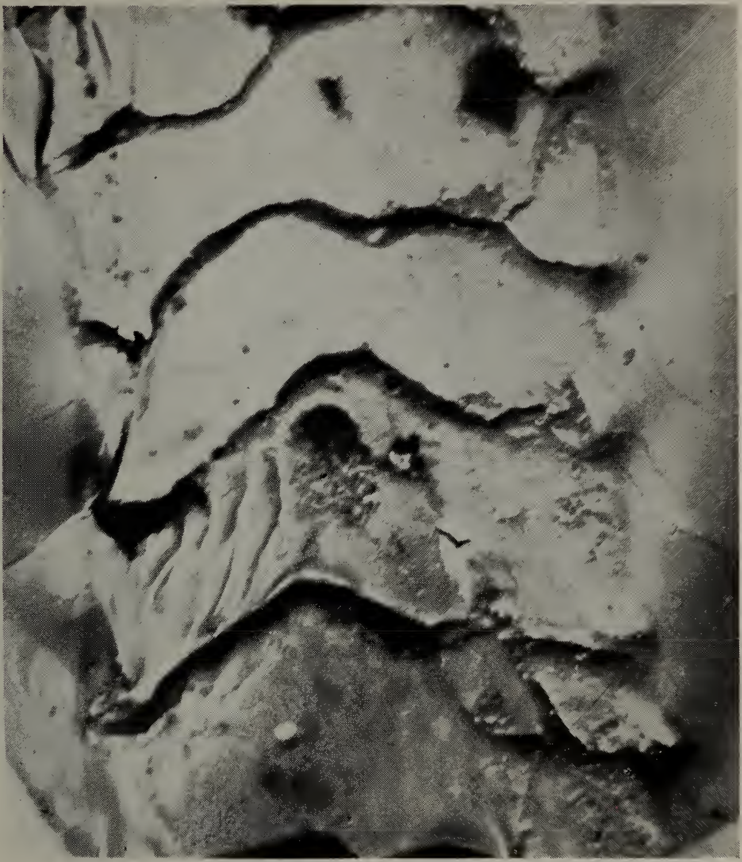

Figure 6. Polystyrene replica of a wool fiber.
Chromium shadowed. — 3,000 X.

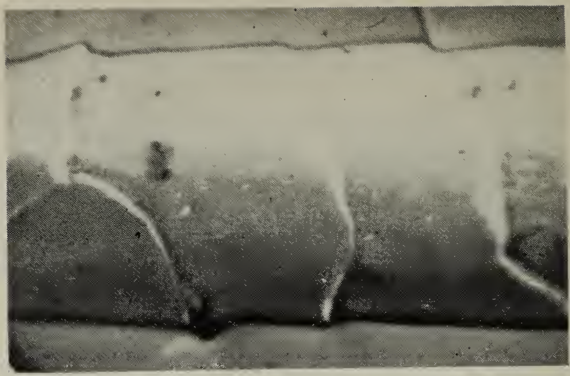

Figure 7. Polystyrene replica of a Cashmere fiber.
Chromium shadowed. — 3,000 X.

Figures 8a and 8b are chromium shadowed polystyrene replicas of the textile fiber dynel. In Figure 8b, the fissures evident along the sides of the replica were probably introduced during the removal of the original fiber from its cast. In both, longitudinal striations are visible along the fiber axis.

Figures 8a and 8b. Polystyrene replicas of dynel.
Chromium shadowed. — 3,000 X.

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A STROBOSCOPIC STUDY OF ENDLESS CHECK STRAPS

by

Albert E. Chouinard*

I. Introduction

The development and use of the automatic loom was dependent on uniform spinning, slashing, and a mechanical drive. Although the first patents for automatic looms were taken out in the late 1700's, it was not until about one hundred years later that they were commonly used. The automatic loom used in the present day textile industry is basically the same loom as that which was put into use in the late 1800's.

The uniformity and quality of cloth being woven on the modern high speed loom is dependent largely on the balance and control in the picking motion. Also, it has been quite truthfully said that the greatest deterrent to higher speed in looms is the limitations in the picking motion components.

Through the years there have been probably more patents issued on modifications of picking motions or on entirely new ones than for any other motion on a loom. However, in spite of all this productive activity, the picking motion consists of a cam driven picker stick which throws the shuttle out of the box on either end of the loom. Because this stick travels beyond the control of the cam at one end of the stroke and also because it must be properly positioned to accept the shuttle on its return flight, a leather strap called a check strap is usually used.

The design and dimensions of this strap vary somewhat for different looms; however, its function is essentially the same in each case. Until most recently, it was believed that the only important service that a check strap performed was to check and use up the residual energy of the shuttle's flight after it had entered the box. Studies made in the last decade using high speed photography have shown that the picker stick in a travel of about 7½ inches accelerates the shuttle to a speed of about 28 to 30 miles per hou · and that by the time the shuttle enters the opposite box it has reduced its speed to about 22 miles per hour. The interesting result of this consideration is that the check strap on the loom is struck by the picker stick at just about the time that it has reached maximum acceleration and is leaving the toe of the cam which drives it. Much of this energy, at least the amount to overcome its inertia and to decelerate it, is transferred to the check strap. This is unavoidable as it is by this mechanism that the strap is pulled forward to be in position to receive the stick as it returns. The stick returns much more slowly as it is merely drawn back by a spring aided by the rebound off the bumper. However, as is well known, the stick must not be permitted to return all the way back, but must be caught and held at some calculated point called the check point. This then becomes the primary service of the check strap.

Thus, when the shuttle enters the box, it is partially slowed down by the resistance of the back binder. At this point the check strap being held at the check point comes into play. The remaining energy of flight of the shuttle is used up in driving back the picker stick to the lay end.

The summation of forces involved in checking is as follows:

1. The force necessary to overcome the inertia of the stick.
2. The force necessary to overcome the inertia of the strap.
3. The force necessary to overcome the friction on the strap as it is drawn through the adjustable fingers.

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*Professor and Head of the Department of Leather Engineering, Lowell Technological Institute.

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The first two forces are constant and only the last is variable. Thus by change of position of the adjustable fingers a control is maintained on the flight of the shuttle. It is for this reason that this strap is called a check strap even though it actually receives only a fraction of the total flight energy of the shuttle. It is quite important that the shuttle arrive at the lay end of the box with zero energy. If it comes in too fast, it will rebound causing loose filling and poor bobbin transfer. If it does not come in far enough the pick stroke will be short and the loom will "bang-off." It must always arrive "home" at the same instant that it is completely stopped. This control is entirely dependent on the adjustment of the friction on the check strap and no doubt is the primary function of the strap. However, as this strap must be drawn forward each pick to be in position to receive the shuttle on its return, the force which is absorbed by the strap as the stick hits it at maximum acceleration of the stroke is of prime importance in relation to strap life.

Previous studies with high speed moving pictures have conclusively shown that this impact of the stick on the forward stroke is so great that flexing is generated in the portion of the strap just entering the friction fingers. This in itself adds further inertia to the forward positioning of the strap.

The most common type of strap in use today is the so-called straight strap, which is passed through the friction fingers forming a circle or elipse around the stick. The ends are laid one on top of the other and bolted to a stationary bracket directly opposite the friction bracket. In operation this strap moves backward and forward with a motion which is partially linear and partially rotary. Due to this partial rotary motion, the strap must slide across the face of the stick. These three characteristics, the sliding across the stick, the looping of the strap and the rigidity of one side all add up to great resistance on the forward stroke of the unit. This easily explains the relatively short life of this strap on high speed looms.

In the late thirties a strap was designed which was eliptical and free to move forward or backward through friction brackets on both front and back sides of the lay. This strap called an endless strap did not display any of the three undesirable characteristics mentioned in the preceding paragraph as being peculiar to the conventional straight strap.

II. Purpose of Test

During the relatively short time that the endless check strap has been in use, several modifications in its design have been made. There have also been a variety of materials used in its construction with varied and unfounded claims often associated with them.

It is the purpose of this investigation to compare the characteristics of a one-piece standard width strap with those of a four section multiple type strap in order to determine if either construction has any particular advantages.

III. Materials and Methods

All of the tests were conducted using only endless check straps. In each case a one-piece leather endless check strap was compared to a multiple type rubber fabric strap. The straps selected in all cases were from standard commercial sources as readily available in our laboratory.

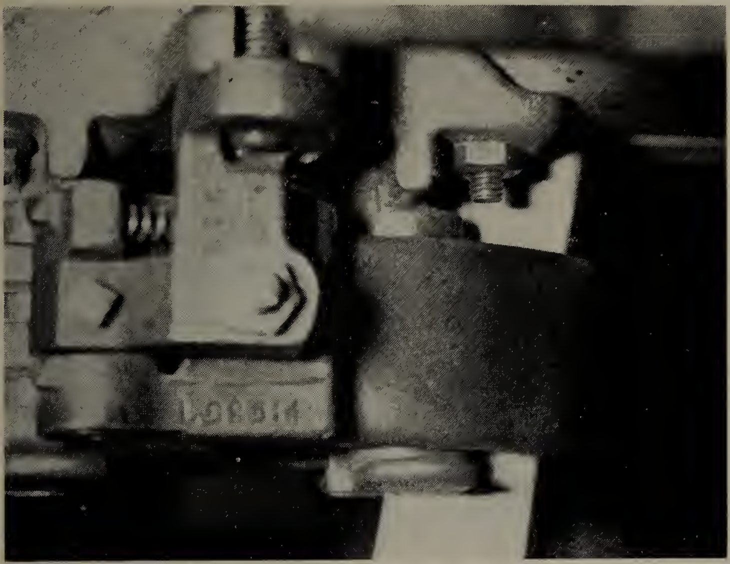
The series of tests were conducted on a 40″ X-2 Draper loom operating at 196 p.p.m. Although pictures were taken in small increments of travel throughout each cycle, we concentrated on those points referred to in the introduction as being the critical points, *i.e.*, the points of stick travel forward and backward when the stick was in contact with the strap.

The pictures were taken with a Leica III A attached to a sliding focusing attachment. A 90 mm. lens was used, set between f 5.6 to f 6.3, and the shutter was left open, the exposure being equal to the duration of a flash of the "Stroblume," approximately 1/700,000 second. It can readily be seen that even though the loom was operating at 196 p.p.m. complete detail was obtained in each picture. Thus, a series of these "action" pictures showing intervals in the cycle can be pieced together to yield interesting conclusions.

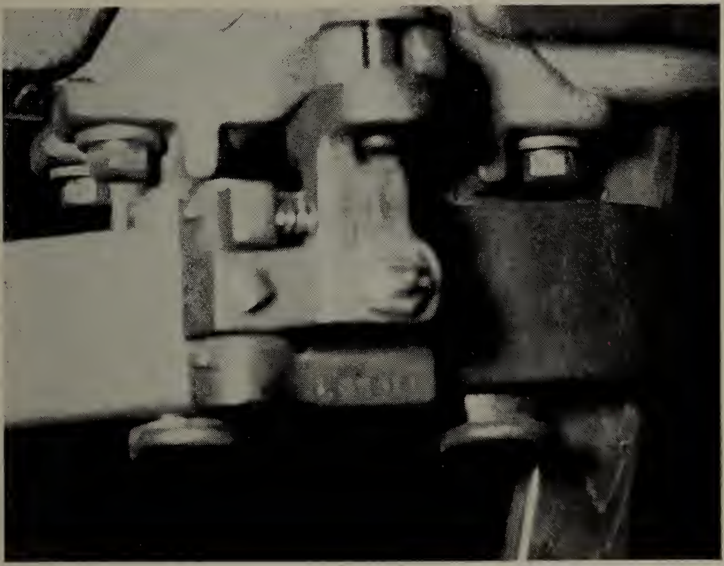
IV. Experimental Data

Series No. 1 — *One Piece Leather-Endless Check Strap*

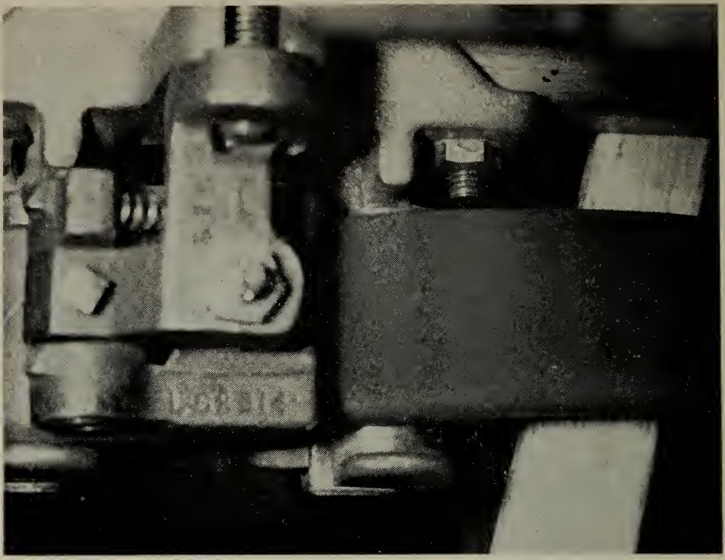
Conditions: Picker stick driving shuttle from box. Series taken from time stick first contacts the strap on the forward stroke.



The stick has just struck the strap and is driving it forward, note that the strap is in full contact with the face of the leather at this moment when the blow is the greatest. This can readily be seen as the stick at this point is just beyond the perpendicular position.



The stick has moved forward only a short distance beyond that of the previous picture. However the strap has already left contact with the stick and is moving away from it. This might in some ways be compared to the conditions which arise when a baseball is struck by a bat.

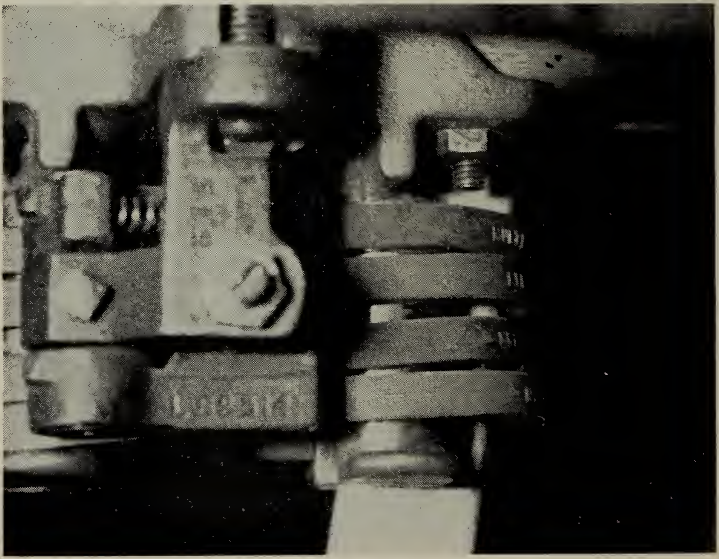


Here it can readily be seen that the strap has traveled considerably beyond the stick.

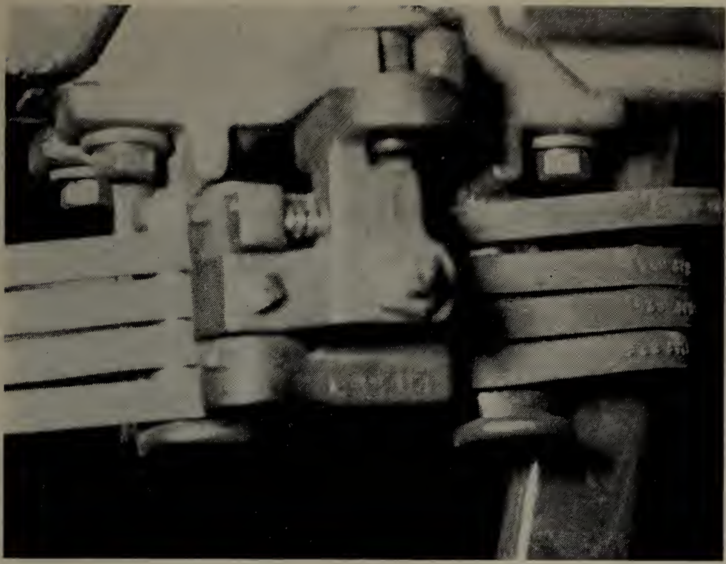
Series No. 2— *Rubber Fabric — Multiple Endless Check Strap*

Conditions:

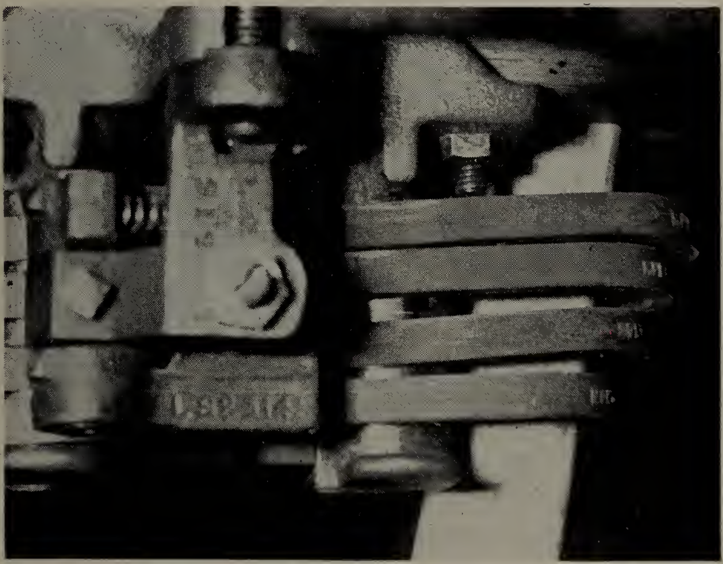
This series shows the same portions of the forward stroke of the picker stick as Series No. 1.



Note that as the stick is coming forward to strike the strap that the sections are not presented so as to receive the blow as a unit.



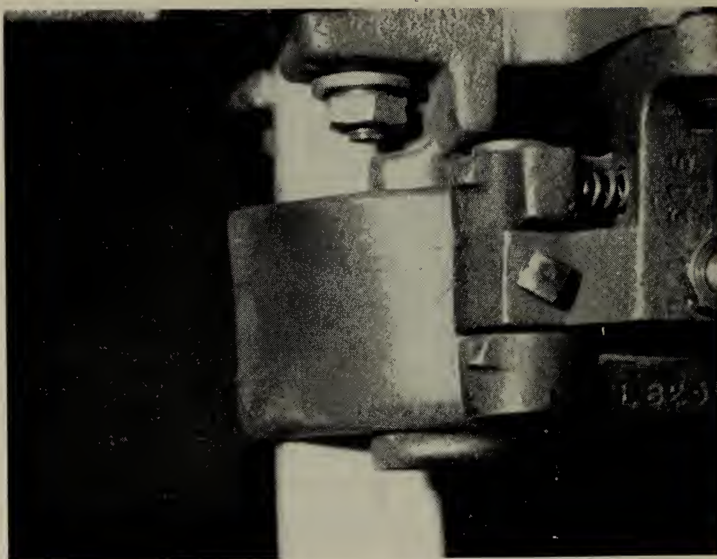
The stick has now struck the strap and fired the strap forward; however, each strap shows a different position of travel, such that it is indicated that the blow was absorbed by the individual straps successively.



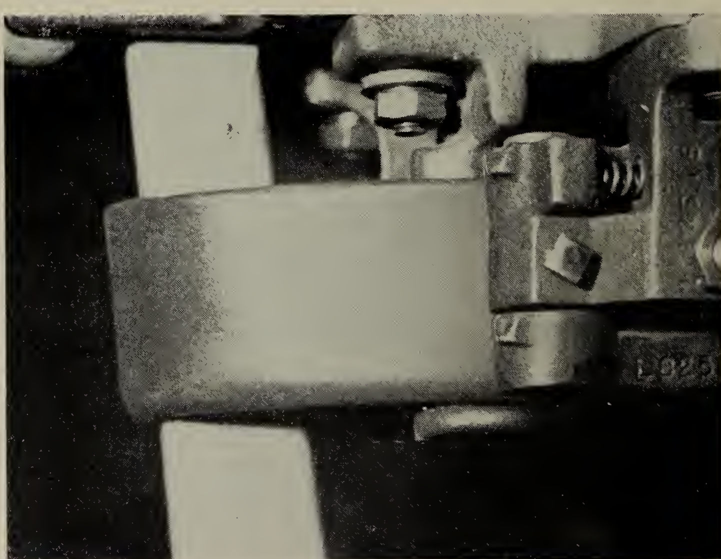
The upper section has reached its extreme point of travel and the others are about to do so.

Conditions:

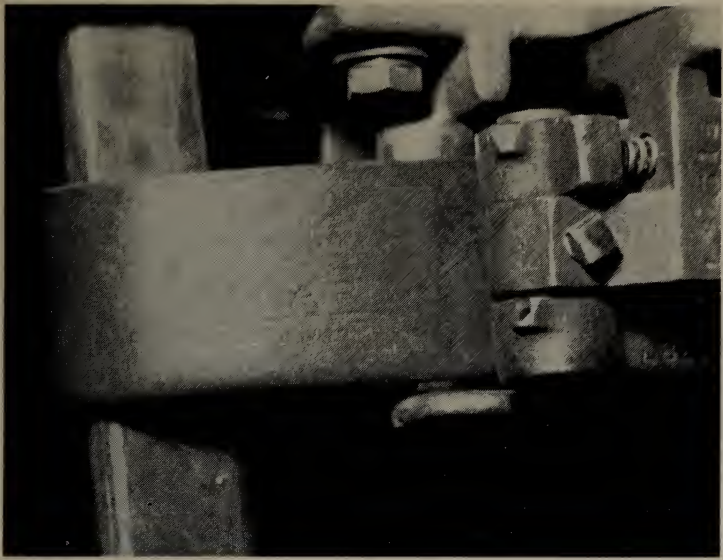
Picker stick returning after ejecting shuttle.



The stick is now being returned merely by the spring tension applied to the heel strap. There is full contact with the leather here as the stick is just about perpendicular.



The stick is now being held at the check point, awaiting the return of the shuttle. The strap to stick contact is excellent; there is no distortion as the leather easily conforms with the slight angularity of the stick.

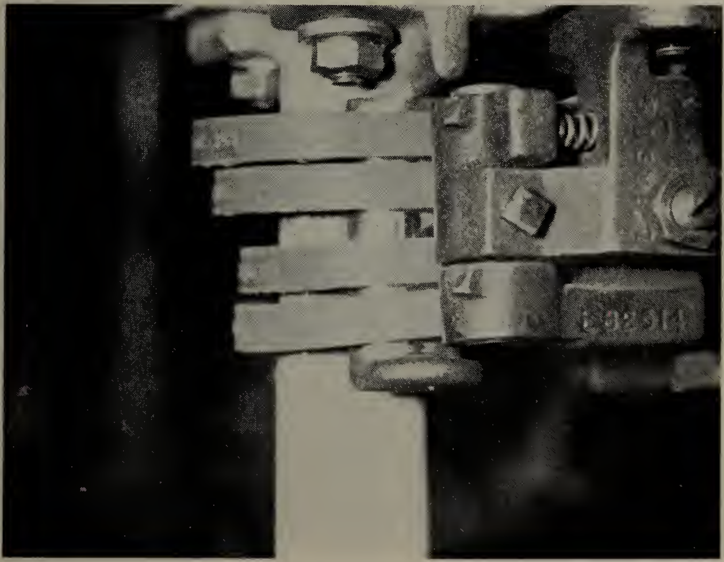


The shuttle has now come into contact with the picker and has driven the stick against the lay end drawing the strap through the friction fingers. The energy to do this is that which was received from the shuttle in halting it at the proper point in the box. This is the true purpose of strap in what is known as checking.

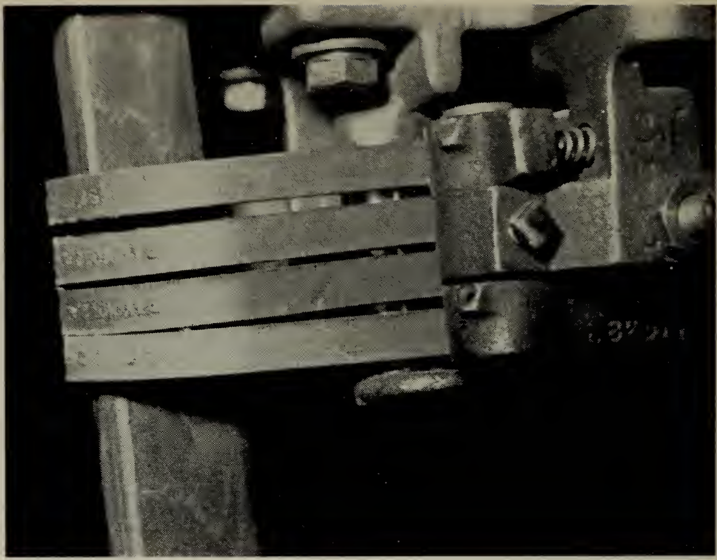
Series No. 4 — *Rubber Fabric — Multiple Endless Check Strap*

Conditions:

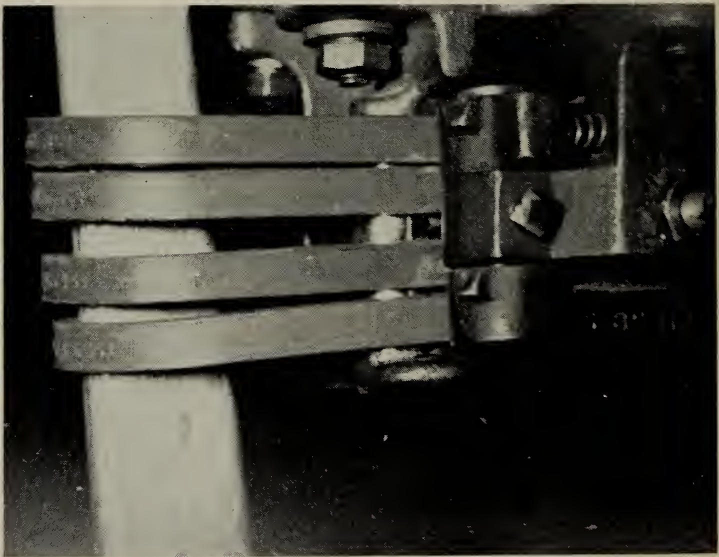
This series shows the same portions of the return stroke of the picker stick as Series No. 3.



In the return stroke of the picker stick it is indicated that each section of the strap is brought into contact at a different point.



The stick is being held at the checking point awaiting the return of the shuttle. However, some of the straps are in contact laterally, others are not. This would indicate variation in frictional contact between the individual sections.



The shuttle is in the box and the stick is against the lay-end. The strap, because of its uneven characteristics, is unevenly displaced both vertically and horizontally.

V. Conclusions

These stroboscopic pictures, taken by increments through the important portions of the cycle when the stick is in contact with the strap, explode many previous and unsubstantiated ideas.

The following conclusions can readily be drawn from these photos:

1. Any endless check strap does not stay in contact with the stick for any great amount of time or travel as the shuttle is being thrown out of the box. The strap is actually fired away from the stick, just as a baseball from a bat.

2. Because of its unit construction the leather endless check strap absorbs this blow over its entire width while its edges contract slightly to conform to the stick.

3. The point of contact on this, the forward stroke, is only just beyond the perpendicular, and thus no material allowance is necessary because of angularity of the stick. By the time that the angle becomes appreciable, the strap is no longer in contact with the stick.

4. The above considerations are significant in all cases as this is the particularly damaging portion of the cycle for any check strap.

5. The multiple check strap absorbs this blow successively and without the support of any of the other members as this takes place.

6. Thus momentarily each strap is exposed to the full force of the blow. This is a good example of the old adage of "Divide and Conquer."

7. Because each section of the multiple check strap is independent and because the friction fingers are not truly parallel each one exerts a different degree of friction.

8. Moreover this friction will vary if the sections move upwards as they travel forward through the bracket, a fact already observed.

9. On the return or checking portion of the cycle, the stick is again exposed to the multiple check strap in various positions, giving a lack of uniform checking ability.

10. The vertical travel of the sections in relation to each other also indicates a varying checking ability.

11. It would follow that the check strap is in contact with the picker stick at points where its angularity is slight. Thus it does not seem that any modifications are necessary beyond the natural ability of the leather to conform.

12. The construction of the multiple check strap actually creates more serious problems and inefficiencies than the one which it was designed to overcome. It seems to have been designed to solve a problem whose dimensions have been largely magnified.